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The Validity of the National League for Nursing, Pre-Nursing and Guidance Examination and Some Other Factors in a School of Nursing

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THE VALIDITY OF THE NATIONAL LEAGUE FOR NURSING PRE-NURSING AND GUIDANCE EXAMINATION AND SOME OTHER FACTORS IN A SCHOOL OF NURSING

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VITA

Sister M. Joel Lampen was born in Carlyle, Illinois November 14, 1916.

She graduated from Saint Mary's Parochial School and Saint Mary's Central High School in the above city. In 1938, she entered the novitiate of the Congregation of the Poor Handmaids of Jesus Christ, Donaldson, Indiana, and attended Ancilla Domini, a junior college conducted for the members of the Congregation. After transferring to Loyola University, Chicago, Illinois, in 1945, she received her Ph.D. degree with a major in history in February, 1949. Additional work was undertaken at De Paul University, Chicago, Illinois. During the summers of 1952 to 1956, she attended Saint Mary's Graduate School of Theology, Notre Dame, Indiana, receiving her M.A. in Sacred Doctrine in July, 1956.

Sister has taught in the elementary schools at Saint Paul's, Fort Wayne, Indiana, and Saint Henry's, Chicago; in the high schools at Angel Guardian and Saint Augustine's, Chicago; and at Ancilla Domini, the Community aspiranture at Donaldson, Indiana, where she was also Director of Guidance.

In January, 1963, after a sabbatical leave of a year and a half during which time she engaged in full-time study toward completing the requirements of the doctoral program, Sister M. Joel was appointed President of Ancilla Domini College, Donaldson, Indiana.

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CHAPTER I

INTRODUCTION

The Purpose of the Research

Today, admissions committees of most educational institutions beyond the secondary school utilize tests for the selection of applicants. A good selection test used in conjunction with other information should give indication of the prospective student's potential for completing the program and for succeeding in the field for which the program offers preparation. The results of such tests should also assist in the guidance of the students by pointing out their specific strengths and weaknesses.

To a school of nursing, also, and its committee on admission, the wise use of tests and other selection tools is of paramount importance. Because the demand for nurses has far exceeded the available supply, the field of nursing has long been one of opportunity. The number of girls entering nursing schools has shown a general increase over the years, but the high withdrawal rate continues to be a problem despite the various admission testing programs and selection devices. During the past two decades, for example, one-third of the girls who enrolled in nursing programs each year withdrew before completing the program.[1] To produce the maximum number of nurses[2] and yet to prevent the social

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[1]American Nurses Association, Facts About Nursing (New York: The Association, 1960), p. 77.

[2]According to Nursing Resources: A Progress Report of the Program of the Division of Nursing Resources, Public Health Service Publication No. 551 (Washington: U.S. Dept. of Health, Education and Welfare), Chart 9, it is estimated

waste resulting from accepting those not qualified and to avoid the frustration and discouragement of students who fail in the nursing education program, faculties of nursing schools continue to evaluate the various selection criteria in an attempt to find better assessing instruments, more effective selection procedures.

In evaluating the usefulness of a battery of tests in the selection process, the most important criterion, one that a school of nursing will wish to check very carefully, is the predictive validity of the battery. Validity may be defined succinctly as "the degree to which the test actually measures what it purports to measure."[3] In other words, how effective is this test or battery for the specific purpose to which it is put? To what extent does it accurately indicate future learning success in the nursing program? Before using a test, a faculty will want to know: How does this test function for all groups using it? After having used a test for some time, a faculty will want to find out how useful the test has been in the local selection process. How does this test function in this particular situation? In making a comprehensive study, not only will it be well to evaluate the predictive ability of the entire examination, but also to obtain information about the relative effectiveness of each test in the battery. For example, does each test contribute to the prediction of success in becoming a nurse or is there a great deal of overlap in the various tests in this respect? Can one or more be discarded as being of little use? Which ones have the greatest value as predictors and, therefore, should be given the greatest weight in evaluating the applicant? What ranges or score limita-

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that, by 1970, 270,000 additional nurses will be needed over and above the normal increase in nursing resources expected during the next ten years.

[3]Anne Anastasi, Psychological Testing (New York: Macmillan Company, 2d ed. rev., 1961), p. 29.

tions can be recommended as indicated by the relationship between scores and success in the nursing school and on the licensure examination?

Since St. Joseph Hospital's School of Nursing, Fort Wayne, Indiana, has been using the National League of Nursing Pre-Entrance and Guidance Examination (hereafter referred to as the NLN PNG) since 1950, it is fitting that a critical and comprehensive appraisal be made of this particular instrument and its predictive value in the nursing education program. Various studies have shown that the validity of the NLN battery or portions of it has varied from school to school, probably because of differences in admission and retention requirements of the schools as well as differences in criteria variables. A significant but limited correlation study was made by Schotzko[4] on the first hundred applicants who took the American Council on Education Psychological Test (hereafter referred to as the ACE--a portion of the NLN PNG test battery) and who subsequently passed the licensure examination. She found highest relationship existing between the linguistic or L scores and success as measured by passing the State Board Examination.[5] The expectancy tables constructed showed that at least two-thirds of all students whose L scores were above the mean also made scores above the mean on the licensure examination, whereas about two-thirds of those whose L scores were below the mean also made scores below the mean on the licensure examination except in one area of clinical nursing.[6] No upper or lower limits were established, however, and she recommended that a study be made also of the other tests in the battery to determine their relative importance and predictive validity.[7]

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[4]Sister Mary Theodorita Schotzko, "A Statistical Analysis of Test Data for Use in the Selection of Nursing Students" (unpublished Master's thesis, Catholic University of America, 1958).

[5]Ibid., p. 23.

[6]Ibid., pp. 37-38.

[7]Ibid., p. 38.

Moreover, a cursory survey of test results over the years as related to subsequent performance in school achievement poses a question at times as to the wisdom of decisions made in admitting or refusing candidates on the basis of information received and weighed. What Henry Chauncey, President of the Educational Testing Service, said of college admissions applies equally to the selection of applicants for nursing:

> Test scores, no matter how revealing, are not intended as a substitute for data such as the individual's previous record, his extra-curricular interests and his attitudes toward his education. It is only through the use of tests together with other sources of understanding of the individual that the best decisions will be made.[8]

Cognizant of the fact that other causative and intangible factors, such as personality difficulties, poor study habits, unrealistic interest patterns, and personal problems are at work to influence a student's achievement and success, we would like to probe below the surface by making a post hoc analysis of the cumulative records in an effort to minimize the attrition rate and to aid in the selection process. Therefore, in making a follow-up study of the validity of a test and its usefulness in determining admission policies, it seems appropriate to compare the relative and combined validities of high school achievement data and other information given on the application form to find what part these also play in contributing to the prediction of success or failure of the applicant. Is it possible that they may be of more importance than the scholastic aptitude and/or achievement subtests in the battery? What is the degree of relationship between scholarship in the high school, as represented by grade averages, and scholarship in the nursing school; between high school scholarship and passing the licensure examination? How much value can be given to the

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[8]Henry Chauncey, Annual Report to the Board of Trustees, A Report to the Educational Testing Service on Test Development and Analysis, Princeton, New Jersey, 1955-1956 (Princeton Educational Testing Service, 1956), p. 23.

intelligence test score on the high school transcript? Do high school marks in mathematics, science, and/or English differ appreciably from the general high school average; and if so, do any of these correlate significantly with success in nursing education?

The Questions to be Investigated

This investigation is concerned primarily with answering the following question: How valid are the various tests in the NLN PNG battery as predictor variables in determining the applicant's subsequent scholastic success--success defined as graduation from the school of nursing and passing the licensure examination?

Furthermore, due to the emphasis placed on theory and clinical practice at various stages in the nursing school programs, the author seeks to determine the correlations between (1) the predictor variables and the first-year averages in the school of nursing; and (2) the predictor variables and the final averages in the school of nursing to note any significant trend or difference as indicated by these coefficients and to see which average is more closely related to the SETP examination.

Then, in order to make the study as complete and as meaningful as possible, the writer hopes to answer this question: What variables might prove valuable in setting up a practical regression equation in predicting success as defined above? In determining such an equation, however, the author wishes to consider, too, pertinent facts as furnished by the high school transcript which may be of value in establishing a formula for prediction. Therefore, she likewise asks: What relation exists between the high school average and/or rank and success in the nursing program? How does this compare with the coefficients of correlation found on the NLN PNG tests? Of what importance is the high school

intelligence test as a predictor?

Another facet that concerns the admissions committee is that so many students withdraw from the program. What characteristic differences, if any, can be found both in NLN PNG scores and in background information as given on the application forms that may aid in the selection process and in lessening the attrition rate? In this part of the investigation, therefore, the writer will compare the "success" group with those who withdrew. Although this third section of the study does not purport to be an exhaustive one (this particular phase of investigation is a research project in itself), the writer hopes to supplement and complement the test data with other facts attainable from the cumulative records in order to discover any differences that may exist between the groups that may be symptomatic clues to dropouts and failures.

Before proceeding with the investigation as outlined, however, a description of the predictor and criterion variables is in order, as well as basic background information on the status of prediction theory in general and of pertinent research in the nursing area in particular so that the reader will understand the problem more fully.

The Predictor Variables: The NLN PNG Battery

The National League for Nursing Pre-Nursing and Guidance Examination, commonly referred to as the NLN PNG, consists of a battery of five tests—scholastic aptitude, reading, achievement tests in arithmetic, natural science, and social studies—and requires 230 minutes to administer.[9] According to the League, "The tests chosen for this battery are designed to measure capacities and proficiencies related to the development of registered nurse competencies

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[9]Oscar Buros (ed.), Fifth Mental Measurement Yearbook (Highland Park, New Jersey: Gryphon Press, 1959), p. 938.

that might reasonably be expected of high school graduates."[10] The tests are changed from time to time to keep pace with new developments and to prevent familiarity with test content.

The battery may be taken by applicants to any state-approved school of professional nursing in the United States, its possessions and in Canada. It is used almost entirely for applicants to diploma schools, since applicants to degree programs usually take the same examination given to candidates for other programs in the colleges. Usually it is administered as a group test in selected centers all over the country at the request of the school of nursing or of applicants to these schools. Directions for the test are standardized. The battery is administered in one day with time allowed for luncheon. The League schedules the testing dates, assumes responsibility for its administration by a psychologist or psychometrist, and scores all tests. Individual profiles of test results are sent to the schools designated by the respective applicants. Results are reported as raw scores and as percentiles, the latter based on the scores made by all applicants who took the test during the preceding year. The Shaycoft study[11] recommended that each school determine its own admission standards, however, and the League's Testing Service so advises.[12]

The NLN Test of Academic Aptitude.—At the time of this study this test was the American Council on Education Psychological Test, often referred to as the ACE. The test, prepared by the Cooperative Test Division of Education Testing Service, has enjoyed wide acceptance as a test of scholastic aptitude

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[10]National League for Nursing, The Use of Tests in Schools of Nursing, The National League for Nursing Pre-Nursing and Guidance Examination Pamphlet No. 1, 3d ed. (New York: National League for Nursing, 1961), p. 3.

[11]Marion Shaycoft, "A Validation Study of the Pre-Nursing and Guidance Test Battery," American Journal of Nursing, LI (March, 1951), 205.

[12]National League for Nursing, loc. cit., pp. 26-29.

for college freshmen generally and for professional schools as well, including schools of nursing. It is termed a general intelligence test and consists of six sub-tests, three of which (Arithmetic, Figure Analogies, and Number Series) involve mathematical and spatial abilities. The former three yield the quantitative or Q score; the latter three yield the linguistic or L score; the total score is the sum of the Q and L scores.

Although Super[13] referred to the ACE Psychological Test as one of the most valuable group tests of intelligence and said that adequate funds for necessary research had made it possible to develop this test as an unusually valid and reliable instrument,[14] more recently Anastasi stated, "The Linguistic and Quantitative scores seem to be factorially complex and hence difficult to interpret. Speed also plays an unduly prominent part in determining these scores."[15] She also added that in the large number of follow-up studies the results varied widely with the level and heterogeneity of the sample and with the nature of the courses.[16]

The MLN Reading Comprehension Test.--This test is from the Cooperative English Test, Higher Level, of the Educational Testing Bureau and consists of two parts: Speed of Comprehension, and Level of Comprehension. The first part takes into account both the speed and the accuracy with which the person taking the test can read materials of varying degrees of difficulty; the second measures the degree of understanding with which she can read a specific amount of material. Speed is not considered in this latter score.

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[13]Donald E. Super, Appraising Vocational Fitness (New York: Harper and Brothers, 1949), p. xv.

[14]Ibid., p. 123.

[15]Anastasi, loc. cit., p. 227.

[16]Ibid.

The NLN Mathematics Test.--This test, an achievement test adapted from the Cooperative Mathematics Test for grades 7, 8, and 9, gives an indication of the degree to which the applicant has mastered arithmetic skills.

The NLN Natural Science Achievement Test.--This, too, is from the Cooperative General Achievement Test, Test II, Natural Science. It measures general proficiencies in the field of the natural sciences, physical and biologic, such as knowledge of the terms and concepts essential to an understanding of these sciences and ability to comprehend and interpret subject matter in the field.

The NLN Social Studies Achievement Test.--Consisting of the Cooperative General Culture Test, Part II, History and Social Studies, this section of the battery emphasizes general rather than specific aspects of the social studies and provides an estimate of the applicant's background of knowledge and understanding in this area.

The Criterion Variables

Different criteria have been used in defining "success" in the field of nursing. As often practiced in colleges generally, early studies used as a criterion the grade-point average attained in the first six months or preclinical period. A unique but important factor in nursing, however, is that "success" involves more than theoretical concepts and factual knowledge. One may question whether the ability to survive even the first year is a true measure of success. Furthermore, as Stuit discovered, the coefficient of correlation decreased from .54 in the first six months of nursing to .44 during the first year and to .40 after that.[17] Burkhart[18] also reached the same general

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[17]Dewey B. Stuit, Predicting Success in Professional Schools (Washington: American Council on Education, 1949), pp. 170-172.

[18]David K. Burkhart, "The Value of Selected Psychological Tests for Predicting Academic Achievement at General College, Boston University"

conclusion in his study.

A measure of professional success might be the most meaningful, but this information is difficult to obtain objectively. Since the advent of the State Board Test Pool (often referred to as the SBTP) Examination, this test has become a more practical criterion; for, according to state law, no one can engage in nursing without having passed the licensure examination. This represents, if not the ultimate in professional success or development, at least the minimum academic standard for beginning nurses. Moreover, since nursing education curricula emphasize those aspects considered important by state boards of nursing examiners, one would expect graduation to represent the fact that the student is equipped to achieve the status of "licensed" or "registered" nurse. Therefore, in assessing the nursing education program in a given school, directors will want to note whether or not any discrepancies exist between success as measured by graduation and success as measured by passing the SBTP examination and the relationship of both with the predictor variables. From Taylor's survey[19] of the status of predictive studies, it can be deduced that high school grade-point average appears to be related to both academic and clinical grades (.43 and .37 respectively), whereas the ACE L score and Q score show little relationship to clinical courses (.11 and .15 respectively).[20] He states, "In general, the correlation dropped from academic or theory grades to clinical or practice grades, indicating that the best predictors of the former criterion are not necessarily the best predictors of the latter criterion."[21] For this reason

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(unpublished Master's thesis, Boston University, 1949).

[19]Calvin W. Taylor et al., Selection and Recruitment of Nurses and Nursing Students (Salt Lake City: University of Utah Press, n.d., [1963]).

[20]Ibid., p. 33.

[21]Ibid.

we have included seven criterion variables in this study--the first-year average, the final average, and the SBTP standard scores in the five nursing areas--to note the extent of variation, if any.

The State Board Test Pool Examination

At present, the State Board Test Pool Examination consists of five examinations covering the major clinical areas of nursing--medical, surgical, obstetric, pediatric, and psychiatric. The examination integrates knowledge and understanding of basic nursing techniques and subjects by means of situation-type questions of the multiple-choice variety. Since 1950, all states have used this examination in licensing professional nurses. It is a service of the National League for Nursing Education, Department of Measurement and Guidance. Only students who have satisfactorily completed their courses and are within ninety days of graduation from an approved school of nursing may write the examination at state testing centers. Each State Board of Nursing Examiners sets its own passing score. In Indiana and Illinois the minimum passing score is 350 in each of the five areas. (The national mean is 500.) The League scores all papers and returns the results to the State Board of Nursing Examiners who in turn reports to each school the standard scores for the students from that school.

Since passing the examination is absolutely essential to becoming a registered nurse, scores on this examination can be used to judge the validity of the NLN PNG. When interpreting these pre-entrance tests, however, and in making correlation studies, the League Testing Service warns:

> Like other paper and pencil tests, it can measure the knowledge, understandings and judgmental abilities which the candidate for licensure will bring to a nursing situation but it cannot evaluate actual performance in the situation--the examination can tell if the candidate will know what to do but it cannot tell whether she will do it. . . . The licensing authority however must depend upon the fact that she has received her diploma or other

credentials signifying graduation from a nursing school, rather than upon the licensure examination for assurance that she is sufficiently qualified in these respects to give safe nursing care.[22]

For this latter reason, a student's grades earned in a school of nursing, which are a combination of subject-matter mastery and clinical performance, offer additional criteria for correlation study and comparison and will also be used as criterion variables.

Limitations and Assumptions

This investigation of the predictive value of the NLN battery and of certain high school record data in relation to subsequent scholastic achievement in the school of nursing and to success in the SBTP examination has definite limitations. Some of these are stated in the body of the paper in proper sequence, but several general statements are in order here.

The data used are secondary source data. The tests were administered over a period of eight years, which means that the students comprising the sample were not always contemporaries. The record data was derived from various schools with various marking systems and standards. It is realized, too, that considerable doubt has been cast on the reliability and validity of teachers' marks.

The term "validity" of a test is itself rather ephemeral, for it can be affected by extraneous influences and has no inherent or necessarily true or certain nature. Furthermore, the self-selectivity of the group destroys the effectiveness of an instrument designed to measure academic promise over a wider range.

Bearing directly upon the problem of validity coefficients is the

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[22]National League for Nursing, "Studying State Board Test Scores," American Journal of Nursing, LV (September, 1955), 1095.

reliability and validity of any given criterion, for example, course grades, standards or meaning of success, validity and reliability of the SBTP examination; for all criterion measures are only partial in that they measure only a part of success on the job. The problem was to choose the most satisfactory from among those that appeared more feasible.

Furthermore, generalizations made from this study can be applied only to a limited extent to students enrolled in similar schools in similar circumstances.

Finally, there was lack of statistical rigor and methodology in analyzing the complex environmental or experiential factors examined in the study of the withdrawal-failure group. Interpretation here was based on personal judgment as well as empirical evidence.

CHAPTER II

REVIEW OF THE LITERATURE

The Problem of Prediction

To predict the status of an individual requires a knowledge of many variables and of their interaction. Because of the complexities of human life and of the human person, one realizes that prediction poses a formidable problem. Prediction has been approached from various points of view: (1) intelligence or scholastic aptitude tests; (2) past achievement as indicated by school rank or grade average; (3) special aptitude tests; (4) interest inventories, personality tests, attitude scales, study habit scales, and other motivational or situational types of ratings. A brief examination of the status and value of each of these instruments or techniques according to the information presently at hand may lead to better understanding of the problem.

Intelligence Tests.—Theoretically, one of the best predictors of academic success should be a test of mental ability. Brown, however, questions scores on intelligence tests in predicting achievement in college,[1] and experience leads us to concur that these instruments leave much to be explained in attempting to forecast success. Although there are various factors that can be cited which have a bearing on variation in performance, probably the fundamental reason for the dissatisfaction with intelligence test scores in prediction is

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[1]Amy Frances Brown, Research in Nursing (Philadelphia: W. B. Saunders Company, 1958), p. 218.

that, although such tests are designed to measure capacity to succeed, they tell nothing about willingness to use this ability; that is, they indicate in general the extent to which an applicant can master work but do not give assurance that she will master it.

Super concludes that correlation between intelligence tests and grades is not very high. Summaries indicate that in college the coefficients of correlation range from .20 to .70 with the modal coefficients being .30 and .50.[2] Perusal of the literature and of research studies show that intelligence test scores have a definite relationship to success only when combined with other kinds of information, particularly with achievement data.[3] For example, the school grade indicates some measure of how the applicant has been using her ability in the past, and experience has shown that good habits of study developed in high school very likely will be used at the next educational level. The factors related to academic success in high school--aptitude, personal adjustment, interest, study methods--also operate at the college level. It may be that a girl who is very much interested in nursing will exert much more effort than she exhibited while in high school, for experiential evidence demonstrates that underachievers in high school may change considerably as they mature or are given a change of environment or a purposeful goal.

Past Achievement.--Under this category can be placed the high school average, the high school rank, and the high school standardized achievement tests as means of forecasting future success in college. The attention given to high school grades by college counselors as measures of prediction has waxed and

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[2]Donald E. Super, Appraising Vocational Fitness (New York: Harper and Brothers, 1949), p. 90.

[3]Robert L. Thorndike and Elizabeth Hagen, Measurement and Evaluation in Psychology and Education (New York: John Wiley and Sons, Inc., 1955), pp. 230-31.

waned. Before the popularity of scholastic aptitude tests as measures of prediction, much emphasis was given to grades in high school or to rank in the graduating class. Criticism has been leveled at these two criteria, however, for a number of reasons. For example, there exists a wide diversity not only among school systems and among schools in the same system, but also within the school. This disagreement occurs not only in standards used and in factors considered in assigning marks but also in the significance attached to them. Moreover, since schools differ in academic standards, in qualifications of their faculties, in the type of subject offerings, in ability levels of students, and in selection policies, class rank, too, can be deceptive. The following reprint from a research report by Danneskiold and Mills states the basic objections:

> . . . One obvious difficulty in using the high school grade-point average for selection purposes is noted at this point. There is a wide variation in academic standards and levels of accomplishment of high schools not only throughout the country, but within particular cities and regions.
>
> Institutions of higher learning are often faced with selecting from among applicants who come from high schools differing markedly in the academic quality of their student body. This occurs in large cities which contain high schools of many types. It also occurs throughout the nation where sharp differences are noted between certain rural and certain urban high schools.
>
> Even if two high schools may turn out approximately the same quality of academically trained graduates, the standard for grading within each of these schools often varies to a considerable degree. Of course, a true measure of accomplishment in the secondary school would be an excellent predictor of accomplishment at higher institutions. However, due to the unreliability of high school grades they must be viewed with extreme caution when used for accepting and rejecting.[4]

A high-ranking student, for instance, in a school whose students have an average IQ of 125 is likely to be better scholastically than a high-ranking student in a school whose student population has an average IQ of 95. A student in the lower

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[4]The Psychological Corporation, Unreliability of High School Grades a Major Factor in Selection, Nurse Testing Bulletin, No. 552 (New York: The Psychological Corporation, September, 1955), p. 4. [Reprint from Rex D. Danneskiold and James A. Mills, The Predictive Testing Program at the Brooklyn College of Pharmacy (New York: The Psychological Corporation, 1955)].

quarter of one high school may be better prepared than one in the upper quarter in another school.

The subjectiveness of teachers' marks was emphasized in an informative investigation by Carter[5] of variables that enter into the assignment of marks. He indicated that teachers' marks represent not only achievement but also show the effects of intelligence, of the socio-economic status, and of the personality of the student upon the teacher.

Chauncey and Frederiksen aver that

> . . . in general, predictions of college achievement from high school achievement have been found to be fairly accurate; but predictions based on average grades are inferior to predictions from rank-in-class. . . .
> Rank-in-class is more predictive than average grades because it eliminates some of the variability due to differences in grading practices.[6]

They note, nevertheless, that rank is still susceptible to errors arising from differences among schools in the average quality of instruction and the average caliber of the student taught, and more serious, to errors resulting from lack of uniformity in the procedure used to determine rank. For example, School A may base the rank on all students in the school; School B may consider only those in the college preparatory curriculum; School C may compute rank from the average obtained from academic subjects only. In spite of all these difficulties, however, they conclude that rank-in-class is usually the best <u>single</u> predictive index available to the college admissions officer. Correlations around .55 are commonly found between ranking measures and achievement in college.[7]

Various studies seem to substantiate the above statements. For example, Rosen and Van Horn found that high school rank was relatively as effective as

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[5]Robert S. Carter, "Non-Intellectual Variables Involved in Teachers' Marks," <u>Journal of Educational Research</u>, XLVIII (October, 1953), 81-95.

[6]E. F. Lindquist (ed.), <u>Educational Measurement</u> (Washington: American Council on Education, 1951), pp. 87-88.

[7]<u>Ibid</u>.

tests in selecting freshman students and that the addition of a placement test corroborated the former record.[8] Florida State University's comprehensive study, based on entering freshmen, correlated first semester college grades with achievement test scores, aptitude test scores, and high school grade-point average and found that the best correlation was obtained with the high school average, whereas the achievement test scores and the ACE scores gave lower correlation coefficients.[9] Garrett[10] and Cosand[11] in reviewing some 270 investigations covering the period between 1919-1947 and 1931-1950 respectively concluded that at most levels previous academic success is about as good as any other predictor or perhaps a little better and that, at the college level, high school achievement (rank or average) gives a better index than any other measure.

Several studies in the field of nursing do not agree with this, however. Sartain's study of eighty students of nursing found the Potts-Bennett nursing aptitude test almost as good a predictor as any combination studied. This instrument yielded a correlation coefficient of .677 in the sample studied, whereas the high school average with nursing school grades gave a coefficient of .460. He attributes the lower validity of the high school average to a weakness

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[8]Ned A. Rosen and John W. Van Horn, "The Selection of College Scholarship Students: Statistical vs. Clinical Methods," Personnel and Guidance Journal, XL (October, 1961), 150-54.

[9]Florida State University, Office of Educational Research and Service, A Study of Grades Earned by First-Time Florida Freshmen in Relation to Florida State-Wide Twelfth Grade Testing Program Scores, ACE Examination Scores, and High School Records (Tallahassee: The University, 1958).

[10]H. E. Garrett, "A Review and Interpretation of Investigations of Factors Related to Scholastic Success in Colleges of Arts and Sciences and Teachers Colleges," Journal of Experimental Education, XVIII (December, 1949), 91-138.

[11]Joseph P. Cosand, "Admission Criteria: A Review of the Literature," California Journal of Secondary Education, XXVIII (January, 1953), 12-21.

inherent in working with averages which were expressed in terms of letters, numbers, or descriptive adjectives and which he had to convert to a common denominator.[12]

Stuit published an article giving a median of .54 between the scholastic aptitude test scores and grades in the first six months' period in nursing and a median of .43 between the students' previous scholastic records and subsequent achievement for the first six months. Because the size of the coefficient decreased after the first year, he concluded that high scores on scholastic aptitude tests predicted reliably during the early part of the program.[13]

As for achievement tests, two types must be distinguished; namely, the specific fields and the broad fields types. Tyler[14] and Chauncey and Frederiksen[15] agree that the best predictor of success in a particular subject matter field is a lower level achievement test in the same field. Validity coefficients generally compare with those obtained between scholastic aptitude test scores and general measures of college achievement. From the many investigations carried out in a variety of school situations, coefficients of correlation range from .30 to .80 with most of them at or near .55. Lennon illustrated in his study[16] that the rather high coefficients are due to the similarity of items in both types of tests. Anastasi, however, calls attention to the two types of

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[12]A. Q. Sartain, "Predicting Success in Schools of Nursing," Journal of Applied Psychology, XXX (June, 1946), 234-40.

[13]Dewey B. Stuit, Predicting Success in Professional Schools (Washington: American Council on Education, 1949), pp. 170-72.

[14]Leona E. Tyler, Tests and Measurements (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1963), p. 57.

[15]Lindquist, loc. cit., p. 98.

[16]Roger T. Lennon, "The Relationship between Intelligence and Achievement Test Results for a Group of Communities," The Journal of Educational Psychology, XL (May, 1950), 301-08.

achievement tests--the newer, general achievement tests--such as the Iowa Test of Educational Development which probably measure intelligence as well as achievement, and the older, specific subject type such as the Cooperative Test series. She states:

> . . . traditional achievement tests which are more closely linked to specific courses measure more nearly distinct skills and knowledge. For this reason, they are likely to yield lower correlations with intelligence tests than have been found for broad achievement tests. If combined with intelligence tests, therefore, the specialized achievement tests will contribute more unique, non-overlapping variance and may permit better prediction of subsequent outcomes.[17]

The Joint Committee on School-College Relations of the American Association of Collegiate Registrars and Admission Officers and the National Association of Secondary School Principals after they had reviewed the research findings of Douglass, Durflinger, Garrett, Cosand, and others, including an aggregate of about four hundred studies and over a thousand coefficients of correlation, summarize very well the consistent validity of certain prediction variables. They say:

> The correlation between high school achievement (rank in class and/or grade-point average) and general college freshman achievement is about .56; between general achievement test scores and college freshman marks about .49; and between measured intelligence (and/or aptitude) and college freshman achievement about .45. When a combination of rank in class and aptitude test scores is correlated with college freshman success, the correlation is about .64. The combination of these three variables--rank in class, achievement test score in English, and tested aptitude--produces the highest correlation with academic success in college (about .70).[18]

Special Aptitude Tests.--Special aptitude tests have particular significance in measuring artistic, literary, musical, and mechanical aptitudes. The selection of students for professional schools, however, does not involve new

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[17]Anne Anastasi, Psychological Testing (New York: Macmillan Company, 2d ed. rev., 1961), p. 468.

[18]Joint Committee on School-College Relations of AACRAO and NASSP, Rank in Class (Washington: National Association of Secondary School Principals, 1962), p. 4.

types of tests but specially administered testing programs. The evidence does not suggest the need for any special aptitudes not already covered by available tests. A typical battery includes a scholastic aptitude or general intelligence test, one or more achievement tests on pre-professional training, and perhaps an interest or personality test. The intelligence test may be one for general use, or, more often, its content slants toward the particular profession under consideration.

As to validities reported on such tests, Layton[19] sounds a note of caution regarding the use of national batteries without local validation. Follow-up studies at the University of Minnesota School of Dentistry yielded lower validity coefficients and a different pattern of correlations than those found in other published studies. Because of differences in populations, grading standards, curricula, and other local conditions, batteries must be validated within individual schools.

Although psychologists in the past developed tests to identify special talents by means of achievement testing and aptitude testing, today, they no longer think that intelligence measures "innate ability" but rather an unanalyzable mixture of inborn potential and experience. This conclusion also holds for varieties of aptitude tests. So called "ability" as measured by mechanical-aptitude tests, for instance, is partly an outgrowth of mechanical experience. It is impossible to disentangle the natural from the acquired components of aptitude.[20]

Regarding the nature of aptitudes or special talents, from research based on tests it seems that aptitudes are more complex, more dependent on

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[19]W. L. Layton, "Predicting Success in Dental School," Journal of Applied Psychology, XXXVII (August, 1953), 251-55.

[20]Tyler, loc. cit., p. 56.

special kinds of previous experience than we first thought they were. Many special talents are not measurable at all, at least by present procedures.[21] Nevertheless, sound evidence has accumulated that people in different occupations do differ in special abilities. A large-scale study by Thorndike and Hagen[22] confirms this conclusion but also indicates that the degree of success a person will attain within an occupation cannot be predicted from his test scores. A rough sorting process seems to occur, and the goal for users of vocational aptitude tests should be to facilitate this process so that it occurs more quickly with less waste of time and talents.

Personality Tests.—Studies involving the use of personality tests, particularly those of the paper and pencil, group type of inventory, have yielded discouraging results. Although we know that personality is an important non-intellective factor not only in motivation and persistence in academic achievement but also in the nurse-patient relationship, it is a factor which remains too elusive to measure satisfactorily with the instruments now at our disposal. Other reasons advanced for this failure are the vulnerability of objective personality tests to "faking" and/or the desire to "look good" on the part of the subjects,[23] and the influence of various kinds of response sets such as social desirability, acquiescence, or deviance.[24] Moreover, it is difficult

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[21]Ibid., pp. 59-60.

[22]Robert Thorndike and Elizabeth Hagen. 10,000 Careers (New York: Wiley, 1959), pp. 27-8.

[23]Walter Borg and Irene Healy, "Personality and Vocational Interests of Successful and Unsuccessful Nursing School Freshmen," Educational and Psychological Measurement, XII (Winter, 1952), 767-75.

[24]Tyler, loc. cit., p. 73.

to obtain criterion measures from life. From Ellis's[25] examination of inventory scores we learn that these have failed generally in prediction of future success of an individual not only in school, but also on the job, and in personal living.

In the field of nursing, studies by Spaney,[26] Bennett and Gordon,[27] Borg and Healy,[28] Sartain,[29] Potts,[30] to name a few, have also concluded that these personality tests lack validity as well as reliability. Stuit ends his extensive review of personality testing in schools of nursing by stating that these tests cannot serve as predictors but can be used for diagnostic purposes in picking out the extreme deviations.[31] Sigrest's[32] later review of the literature corroborates this earlier finding.

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[25]A. Ellis, "Recent Research with Personality Inventories," Journal of Consulting Psychology, XVII (1953), 45-9.

[26]Emma Spaney, "Personality Tests and the Selection of Nurses," Nursing Research, I (February, 1953), 4-26.

[27]George K. Bennett and H. Phoebe Gordon, "Personality Test Scores and Success in the Field of Nursing," Journal of Applied Psychology, XXVIII (June, 1944), 267-78.

[28]Walter Borg and Irene Healy, "Personality Characteristics of Nursing School Students and Graduate Nurses," Journal of Applied Psychology, XXXV (August, 1951), 275-80.

[29]A. Q. Sartain, loc. cit., p. 234-39.

[30]Edith M. Potts, "Testing Prospective Nurses," Occupations, XXIII (March, 1945), 328-34.

[31]Stuit, loc. cit., p. 184.

[32]Joyce M. Sigrest, "Personality Factors that Influence the Success of the Nursing Student during the Second and Third Years in Three Selected Diploma Schools of Nursing" (unpublished Master's thesis, School of Nursing, University of Alabama, 1957).

Other studies based on the MMPI by Beaver,[33] Weisgerber,[34] Haney,[35] and Finn[36] have yielded similar results and conclusions. Moreover, in a study of women students in liberal arts, teaching, and nursing, Lough[37] found that the test had no value in selection because it did not differentiate between groups with regard to suitability of occupation; and a recent study of the MMPI as a screening device in the Army Medical Service School[38] also stated that there are implications that it may be ineffective in other similar academic situations and may actually influence the screener to reject students who will eventually succeed. Anastasi confirms this consensus by saying, "The field of personality testing is still in a formative stage. Few, if any, available instruments have as yet proved their value empirically to the same extent as have aptitude or achievement tests."[39]

Interest Measures.--One realizes that interests are important. One must be interested in the educational program he is following. Lack of interest contributes to poor performance and failure. The relationship between interest and

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[33]Alma P. Beaver, "Personality Factors in Choice of Nursing," Journal of Applied Psychology, XXXVII (October, 1953), 374-79.

[34]C. A. Weisgerber, "The Predictive Value of the MMPI with Student Nurses," Journal of Social Psychology, XXXIII (February, 1951), 3-11.

[35]H. B. Haney, "MMPI Profiles and Personality Characteristics," Journal of Consulting Psychology, XVII (April, 1953), 142-46.

[36]Patricia Finn, Helen Brunclik, and John Thurston, "The Prediction of Success in Nursing Education," Report presented at the annual convention of the Wisconsin Nurses Association, Milwaukee, November 8, 1961. (Mimeographed) p. 8.

[37]Orpha Lough, "Women Students in Liberal Arts, Nursing, and Teacher Training Curriculums and the MMPI," Journal of Applied Psychology, XXXI (August, 1947), 437-45.

[38]John Hewitt and Leon Rosenberg, "The MMPI as a Screening Device in an Academic Situation," Educational and Psychological Measurement, XXII (Spring, 1962), 129-37.

[39]Anastasi, loc. cit., pp. 632-33.

ability is difficult to ascertain, however. The relationship between interest and achievement is somewhat more clear. Jager and Froehlich point out:

> Since interest is the tendency to give sustained attention to an activity, be absorbed by it, and persist in it, it is natural that an individual will more likely excel in that activity that holds his interest. For that reason, school grades, unreliable as they are, do hold clues to interests.[40]

Interest inventories, however, have serious drawbacks in prognosis. The chief objections are that interests are not always commensurate with ability and are not always evaluated in a realistic manner. Williamson and Darley have labeled it "discrepancy between claimed and measured interests."[41] Strong, too, observes that "interest tests do not correlate to any practical degree with measures of success";[42] and Froehlich states that at times the various means of identifying interests do not yield comparable data, and that occasionally they provide conflicting information.[43]

Some of the most significant facts shown by a review of the many studies dealing with interests, and the experience of guidance workers who have extensively used interest measures are summarized by Froehlich:

> Interests do not appear to have a close relationship to aptitudes. The correlation between a measured interest and a measured aptitude, both in the same field, is positive but relatively low. . . .
>
> The interest test scores of students are not good predictors of achievement in school. Students who are interested in a subject tend to persist in the study of it. They are no more successful, however, than students of equal

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[40]Harry Jager and Clifford Froehlich, "Guidance Tools for Vocational Shop Instructors," Vocational Instructors Shop Handbook, VIII (Fall, 1947), p. 14.

[41]Quoted from Clifford Froehlich and J. G. Darley, Studying Students (Chicago: Science Research Associates, Inc., 1952), p. 279.

[42]E. K. Strong, "Prediction of Educational and Vocational Success through Interest Measurement," Proceedings, Invitational Conference on Testing Problems (Princeton: Educational Testing Service, 1957), p. 72.

[43]Clifford Froehlich and J. G. Darley, Studying Students (Chicago: Science Research Associates, Inc., 1952), p. 279.

ability who express little or no interest in the same subject. . . .

> Interest tests cannot predict occupational success except in a few fields of work, notably salesmanship. It appears, however, that men with high interest test scores in their occupations tend to continue in these occupations longer than those who have low interest scores in that field of work.[44]

Another aspect that renders interest patterns somewhat low in correlation studies is that "while long-range, stable occupational interests begin to emerge in some individuals as early as thirteen and fourteen, most students do not show this stability until they are around seventeen, and some do not stabilize until they are in their twenties."[45]

The most recent review of research studies in the selection of nursing students by Taylor makes this conclusion:

> Personality and interest tests generally exhibit very low or zero correlation with academic success in nursing school. Occasionally a substantial correlation with grades in nursing school is reported for a particular personality or interest test or a sub-score of such tests. However, these significant correlations appear, at the present time, to be exceptions and rarely hold up on cross-validation where the initial results are checked on other samples of students. Furthermore, there is little agreement across studies using the same instrument.[46]

Thus we may conclude that interest inventories, along with personality measures and other similar types of tests, including also attitude inventories, study habit inventories,[47] and the like, have proved of little help in prediction studies to date. A record of past achievement plus aptitude or ability appear to be the best indicators of a student's chance of success in a certain

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[44] Ibid.

[45] Emery Stoops and Gunnar Wahlquist, Principles and Practices in Guidance (New York: McGraw-Hill Book Company, Inc., 1958), p. 58.

[46] Calvin W. Taylor, et al., Selection and Recruitment of Nurses and Nursing Students (Salt Lake City: University of Utah Press, n.d.), p. 56.

[47] J. S. Ahman, William L. Smith, M. D. Glock, "Predicting Success in College by Means of Study Habits and Attitude Inventory," Educational and Psychological Measurement, XVIII (Winter, 1958), 853-57.

area. We should hope, therefore, that the NLN PNG test battery, which is a combination of a scholastic aptitude test and achievement tests ought to be helpful in predicting success in the nursing program. In this study we will refer to the battery and its sub-tests as part of the predictor or independent variables.

Review of Related Prediction Studies

The ACE in General Education

The ACE has been the subject of numerous prediction studies in relation to college survival and achievement. Although the results vary widely with the level and heterogeneity of the sample and with the nature of the course, correlations with four-year grade-point averages cluster around..45.[48] This has seemed sufficiently high to warrent its use, particularly when we keep in mind the findings of Stuit[49] and of Burkhart[50] that the coefficient tends to decrease in size markedly after the first year.

In a very early study, Kornhauser[51] reported that in a comparison of four intelligence tests used in his correlation study, the Army Alpha, the Otis, the Terman McNemar, and the ACE, no one test appeared superior to the others.

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[48]Anastasi, loc. cit., p. 227.

[49]Stuit, loc. cit., pp. 170-72.

[50]David Burkhart, "The Value of Selected Psychological Tests for Predicting Academic Achievement at General College, Boston University" (unpublished Master's thesis, Boston University, 1949).

[51]A. Kornhauser, "Test and High School Records as Indicators of Success in an Undergraduate School of Business," Journal of Educational Research, XVI (1927), 342-56.

Payne[52] found that scores on the ACE yielded coefficients of .46 when correlated with first semester grades at George Washington University. Samenfield[53] reported that high school rank yielded a coefficient of .58 and was the best single predictor but that the addition of the ACE brought the coefficient up to .63 when pitted against college achievement; and recently, Florida State University's study [54] of grades of entering freshmen in relation to ACE scores and high school records also showed similar findings.

Jackson[55] found that in the selection of male students for freshman chemistry, the ACE proved relatively unimportant. DeRidder[56] concluded that performance on the ACE appeared somewhat predictive, although it was also apparent that low scores by themselves did not insure academic failure nor high scores academic success.

Thomann's[57] investigation found both the ACE and the high school rank to be equally reliable predictors of college achievement. Both coefficients of

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[52]Golda Smith Payne, "The Scores on the ACE in Relation to Scholastic Success at George Washington University" (unpublished Master's thesis, George Washington University, 1937).

[53]Herbert Samenfield "Predicting College Achievement," Journal of Higher Education (November, 1943), 432-33.

[54]Florida State University, loc. cit.

[55]Robert A. Jackson, "The Selection of Students for Freshman Chemistry by Means of Discriminant Functions," Journal of Experimental Education, XVIII (March, 1950), 209-14.

[56]Lawrence M. DeRidder, "Relationship between Gross Scores on the ACE and Academic Success," Journal of Educational Research, XIVI (January, 1953), 353-58.

[57]D. F. Thomann, "Relationships between the High School and College Editions of the ACE Psychological Examination and Their Relative Value in Predicting College Achievement," College and University, XXIII (1948), 217-33.

correlation were .44; whereas Scannell[58] found that high school grade-point average consistently yielded the highest correlation with college-four-year grade-point average when matched with the ACE and the Iowa Tests of Educational Development.

A survey of 263 college admission-selection studies for the years 1949-1959 made by Fishman and Pasanella[59] revealed that the high school record correlated around .50 with comprehensive freshman-year intellective criteria while the correlations of scholastic aptitude test scores averaged .47.

Berdie's study of the L and Q scores of the ACE noted sex differences on these two sub-tests[60] and also found that the L scores correlated with total grade-point average in college freshmen better than did the Q scores. The L coefficients ranged, however, from .18 to .65, with the highest correlation in English and fairly high correlations with social and biological sciences.[61]

The ACE and the PNG Battery in Nursing Education Prediction Studies

In nursing as in general education, there is lack of uniformity in the findings. Rhinehart[62] made an early study of a number of pre-tests for selection purposes and found that the ACE had the greatest predictive value for

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[58]Dale P. Scannell, "Differential Prediction of Academic Success from Achievement Test Scores" (unpublished Ph.D. dissertation, State University of Iowa, 1958).

[59]Joshua A. Fishman and Ann K. Pasanella, "College Admission Studies," Review of Educational Research, XXX (October, 1960), 300.

[60]R. Berdie, Paul Dressel, and Paul Kelso, Relative Value of the Q and L Scores of the ACE Psychological Examination, II (Durham, North Carolina: Box 6907, College Station [private printing], 1951), p. 805.

[61]Ibid., p. 808-9.

[62]Jessie B. Rhinehart, "An Attempt to Predict the Success of Student Nurses by the Use of a Battery of Tests," Journal of Applied Psychology, XVII (June, 1933), 291.

grades in theory but that none of the tests were useful in predicting success in clinical areas. Rainier's study[63] showing the relationship between the high school average, the ACE, and the Iowa Silent Reading Tests and the academic achievement of the first semester in the school of nursing found the high school average (.43) but slightly better than the ACE (.42) and the Iowa Silent Reading Test the least effective (.18).

That the ACE does not discriminate sufficiently in categorizing the success and failure groups has been the contention of a number of studies. Using as criterion the passing of the SBTP, Riblon[64] concluded that the ACE total scores for the failures were not conspicuously different from those of other students who successfully completed the program in nursing. Of the upper quartile of the 160 students with highest ACE scores, only 22, or 55 per cent, placed in the upper quartile of their graduating classes. Similarly, only 50 per cent of the expected 40 students fell into the lowest quartile. She further tested the predictive value of the ACE by measuring with National League for Nursing Achievement Test scores. The assumption that the top 25 per cent on the ACE would attain the upper quartile level on the nursing achievement tests was not verified, for only 15, slightly less than one-half, reached this level. (The assumption that the NLN Achievement Tests are valid must be made here.) The same tendency was found in the lower quartile comparisons. Comparing the ranking on the ACE with that on the SBTP composite or total score, she found that only 58 per cent placed in the expected upper third.[65]

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[63]Ruth A. Rainier, "The Use of Tests in Guiding Student Nurses," American Journal of Nursing, XLII (June, 1942), 679-82.

[64]Barbara K. Riblon, "The Relationship between Scholastic Performance in a School of Nursing and Tests for Nursing Achievement" (unpublished Master's thesis, De Paul University, Chicago, 1954).

[65]Ibid., pp. 29-30.

Somewhat similar results were obtained in a detailed study by Hook[66] who examined the records of 276 girls who entered a school of nursing over a period of five years, no two classes of which took an identical battery. Altogether, eighteen different tests were used in various combinations. Using the multiple cut-off method, she found that the ACE was one of the least effective tests for the purpose of selection because of its lack of discrimination. The same indictment was directed against most of the other tests, though to a lesser degree. Those that had some discriminatory value, at the same time would have excluded a relatively high rate of successful students so that she could not establish cutting scores for any of the tests as she had hoped to do.[67]

One weakness of the Hook study, perhaps, is the relatively small sample that took each of the tests. Only four of the tests were given to a hundred or more applicants. Use of the cut-off method also has one serious disadvantage in that failure to meet any one minimal score automatically means rejection, whereas use of correlations and the regression equation allows strengths in certain areas to offset weaknesses in others. Although the cut-off method is easier to interpret and apply, one assumes risk in so doing. This risk was pointed out in the Cardew[68] attempt to establish cutting scores on the ACE or the high school rank. She found that the ACE cutting score at the 40th percentile not only would have eliminated 171 of the 237 failures, but also would have refused admission to 31 students rated as superior or very good. And, if only those in the upper quartile of their high school class had been admitted, 128 who failed

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[66]Marjorie Janette Hook, "Predicting Success in St. Luke's Hospital School of Nursing" (unpublished doctoral dissertation, University of Colorado, Boulder, 1954).

[67]Ibid., p. 306.

[68]Emily C. Cardew, "Evaluating Administration Requirements," American Journal of Nursing, XXXIX (March, 1949), 179-80.

or were below average would not have been admitted, but 112 rated above average in nursing would also have been refused.[69]

Schotzko's statistical study involving the ACE and the SBTP examination at the St. Joseph's Hospital School of Nursing reported coefficients of correlation between total scores on the ACE and the scores in clincial areas of the SBTP ranging from .471 to .630. Quantitative (Q) scores ranged from .324 to .480 and Linguistic (L) scores from .479 to .622. She found that the L scores seemed to be more indicative of general scholastic ability than Q or Total (T) scores. At least two-thirds of those with L scores above the mean also made scores above the mean on the SBTP.[70] She recommended that a study be made of the remainder of the NLN battery to determine the importance of the other sub-tests.

Shaycoft's national validation study of the entire NLN PNG battery concluded that the science score yielded the highest correlation with the SBTP composite and hence she gave it the most weight in the composite score.[71] She also concluded that "good achievement in all areas of the high school program covered in the PNG battery (natural science, history, social studies, and mathematics) seems to be more important than do scores on the intelligence and reading tests."[72] Bruton's investigation also emphasized the importance of the science score but found the history and social studies test of no value in

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[69]Ibid., p. 180.

[70]Sister Mary Theodorita Schotzko, "A Statistical Analysis of Test Data for Use in the Selection of Nursing Students" (unpublished Master's thesis, Catholic University of America, 1958), pp. 36-7.

[71]Marion Shaycoft, "A Validation Study of the Pre-Nursing and Guidance Test Battery," American Journal of Nursing, LI (March, 1951), 202.

[72]Ibid., p. 203.

prediction.[73] The size and type of sample,[74] however, limit the importance of the latter study and any generalization made therefrom.

Mayo's study of various tests which are also incorporated in the NLN PNG battery gave an entirely different picture. Using freshman students at the Emory University School of Nursing (degree candidates), he found that the results of the United States Armed Forces Institute Examination in Senior Science showed no relationship, the George Washington University Series Arithmetic Test and the Cooperative Mathematics Pre-test for College Students contributed negligibly, whereas the Cooperative English test score was the best predictor in the first year of nursing education, yielding a coefficient of .53 for the total English test. Moreoever, the Level of Reading Comprehension test alone (a part of the English test that is used in the NLN battery) gave a coefficient of .52 in his sample. The ACE with a coefficient of .40 for the L score, of .41 for the T score, and of .28 for the Q score came in a poor second. The author was supported in his findings by similar results in another study at Emory for all freshmen. In both studies the total English score had higher validity than the ACE.[75]

Recently, Taylor[76] reviewed over a hundred research studies in the field of nursing and concluded that the College Entrance Examination Board test is the best single predictor of grades in schools of nursing with the ACE and the

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[73]Florrie Erb Bruton, "Some Implications of National Pre-Nursing Tests for the Selection of Students for Alabama Hospital Schools of Nursing," Nursing Research, III (October, 1954), 60-73.

[74]Sixteen persons in the class of thirty-two completed the course and SETP satisfactorily. Moreoever, the students were chiefly from rural areas of Alabama and not too representative of the national population.

[75]Samuel T. Mayo, "Validation of a Test Battery in a School of Nursing," Nursing World, CXXVI (December, 1952), 16-17.

[76]Taylor, loc. cit., p. 25.

Cooperative English test also holding up well. There was, however, considerable range in the correlations of these latter two. He also stated that the Cooperative English test, the ACE, and the California Test of Mental Maturity, in the order mentioned, were the best of the tests included in the studies for predicting success on the SBTP examination. He added, however, that there was little agreement among schools as to the best single predictor of success in schools of nursing.[77]

In addition to Shaycoft's and Bruton's studies of the entire PNG battery, three other investigations by Charles,[78] by Huneke,[79] and by Ferguson[80] on the validity of this particular battery during the freshman term do not show the consistency of results one would hope to find. Charles found that high school rank in the graduating class had the highest correlation with academic success as measured by school grades in the pre-clinical period, and scores on the natural science test the next highest, but the T and Q scores on the ACE plus the natural science score were the most economical predictors of success in the freshman term.[81] Ferguson also correlated the NLN PNG scores with academic success during the freshman term and found rank-order coefficients ranging from

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[77] Ibid., p. 26.

[78] Florence L. Charles, "A Study of the Prediction of Academic Success in the Pre-Clinical Period in the Milwaukee County Hospital School of Nursing" (unpublished research paper submitted to the Department of Education, Marquette University, Milwaukee, 1955).

[79] Winfrid Huneke, "Study of Factors Influencing the Attrition Rate in a Selected Three-Year Hospital School of Nursing for Classes Admitted 1953-56," Nursing Research, VII (1958), 95 (abstract.)

[80] Ruth Herzog Ferguson, "A Predictive Study of Success in the Freshman Term at a Selected Hospital School of Nursing from Scores on the NLN Pre-Nursing and Guidance Test Battery" (unpublished Master's thesis, De Paul University, Chicago, 1960).

[81] Charles, loc. cit., pp. 35-38.

.17 to .42. In keeping with the Shaycoft study, she found that the natural science score yielded the highest validity coefficients. On the other hand, the coefficients derived from the ACE and the reading tests in relation to nursing-school grades were too unstable because of chance errors. Her attempt to find a percentile level below which a majority of students received a grade-point average of less than 2.0 met with no success.[82]

In contrast with Ferguson's coefficient of .33 (with a S.E. of .09), Huneke found a .64 coefficient of correlation between ACE total score and school of nursing averages and concluded that the ACE total percentile was the best single predictor of success. In general, students falling below the 30th percentile were poor risks for admission.[83] This conclusion, however, based on the use of percentiles raises another question, for McNamara's study using percentile scores on the ACE and scores on the SBTP stated that the use of percentiles was a limitation.[84]

Several other studies apropos to our investigation deserve mention. Doyle correlated achievement on the SBTP with high school average and high school rank and reported low but significant relationships between high school average and achievement in four nursing areas and no significance between high school average and achievement in two areas.[85] LaRow found significant

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[82]Ferguson, loc. cit., pp. 14-29.

[83]Huneke, loc. cit., p. 95.

[84]Sister Mary Redempta McNamara, "A Study of the Relationship between the Percentile Scores on the American Council on Education Psychological Examination and the Scores Made on the State Board Test Pool Examination by a Selected Number of Nursing Students" (unpublished Master's thesis, School of Nursing Education, Catholic University of America, 1954).

[85]Sister Mary Patricia Doyle, "A Study of the Scores Made by One Hundred Fifty-nine Students in a Selected Three-year School of Nursing on the State Board Test Pool Examination and Their Relation to High School Average and High School Rank" (unpublished Master's thesis, Catholic University of America, 1953).

relationship between rank in high school and withdrawal for scholastic failure and also between rank in high school and scores of four of the five clinical areas of the SBTP examinations and concluded that rank in high school is a fairly reliable index of probable scholastic success.[86] Hartranft, using the composite SBTP score as criterion, found the ACE to be the best predictor of the tests studied but also found that 66 per cent of the variance was associated with variables other than the ACE, scientific ability, and high school rank.[87] MacDonald utilized the NLN composite raw score against various criteria and reported a coefficient of .37 between the NLN and total grade-point average, a coefficient of .63 with SBTP scores, and one of only .03 with ratings of job performance.[88]

Summary of Validity Studies

For many years researchers have been seeking promising tests, including various scholastic aptitude tests, special aptitude tests, achievement tests, personality and interest tests, either in the best combinations or alone, as the basis upon which to predict future scholastic achievement. In addition, these tests have been matched with and against previous scholastic performance as measured by high school grade average or rank in an effort to find the most valid predictors of future educational and vocational success. Statistical

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[86]Sister DeChantal LaRow, "Study of Admissions, Withdrawals, and State Board Achievement in Relation to Rank in High School Class," (unpublished Master's thesis, Catholic University of America, 1958).

[87]Annabelle Hartranft, "Study in a Selected 3-Year School of Nursing in Pennsylvania of the Relationship between Pre-Entrance Examination Scores in ACE, Scientific Ability, Arithmetic Ability, and High School Rank and the Composite Score on State Board Examination for Professional Nurses" (unpublished Master's thesis, University of Pennsylvania, 1957).

[88]Patricia MacDonald, "A Study of Predictive Effectiveness of NLN Composite Raw Scores against Various Criteria" (unpublished manuscript, Deaconess Hospital, Spokane, Washington, 1960).

analysis concerning the predictive validity of the ACE and its correlation with college success in general and with success in the nursing education program in particular has yielded a welter of conflicting results and correlation coefficients of varying degrees of significance, depending to some extent on the criterion used. Some validation studies have pointed to the importance of achievement test scores in English and reading, whereas other investigations stress the importance of the science and mathematics tests scores.

Of the studies that considered the validity of the entire NLN PNG battery, three correlated test scores with the average made in the school of nursing during the freshman term. With the exception of the extensive validation study carried out by the National League for Nursing by its research statistician, Marion Shaycoft, on those who took the test in 1945, other studies of this battery were limited chiefly to finding several correlations between parts of the test and either grade-point average or the SBTP examination. Two studies involved several intercorrelations of predictors but they did not involve a complete evaluation of the total predictive value as related to early and also to more remote success in the school of nursing and on the SBTP examination. No study has been found that concerned itself with correlations and intercorrelations of the NLN PNG raw scores, the high school average, rank, and IQ with the standard scores in the five areas of the SBTP examination and with the first-year and final nursing school averages as well as intercorrelations between criterion variables. Statistical analysis of all of these should produce a complete evaluation of these indices and the use than can be made of them.

Studies of Attrition

Closely related to any validity study is a study of withdrawal or dropouts. This can be likened to the other side of the same coin or the

positive versus the negative approach to the same problem. As mentioned in the introduction, in spite of the fact that various selection devices and instruments have been used and studied for many years, the attrition rate has remained at approximately the same level and is a serious problem. Tate's survey[89] in 1961 found that the average rate for baccalaureate programs was 44 per cent and for diploma programs 30.5 per cent while Cunningham's survey for the League placed it for the latter at 33.2 per cent.[90]

Reasons for dropouts are many; academic failure, marriage, and dislike for nursing continue to be the chief causes in the order given.[91] Each of these, of course, may be hidden in other categories or may be interrelated with each other. As mentioned previously, personality inventories, interest inventories, and rating scales to date have proved to be of little use in prediction studies, so that no pattern of personality characteristics identifying the successful nurse from the unsuccessful candidate has been discovered. The search for more discerning means of identifying the potential dropout continues.

Studies in more projective types of tests are being made at present by Finn, Bruncik, and Thurston[92] in which they hope to find more valid prediction of failures via sentence completion tests. Although Taylor[93] suggested that biographical data as obtained from interviews and application blanks be investigated, Stuit maintained that, in general, there was little correlation between

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[89]Barbara Tate, "Study of Attrition Rates in Schools of Nursing," Nursing Research, X (Spring, 1961), 94.

[90]Elizabeth V. Cunningham, Today's Diploma Schools of Nursing (New York: National League for Nursing, 1963), p. 41.

[91]Alma Clark, "Study of Attrition in a Hospital School of Nursing," Nursing Research, VII (October, 1958), 135 (abstract.)

[92]Finn, Bruncik, and Thurston, op. cit.

[93]Taylor, op. cit., p. 14.

personal history data items and scholastic achievement, at least within the range of normal student populations.[94] A limited study by Gregorius also found no consistent pattern of individual characteristics, including family education and background.[95] Super says that the evidence shows that the present subjective methods of evaluating applicants by means of letters of recommendation, interviews, etc., add little or nothing to the predictive value of validated objective tests and cites as examples the numerous studies of the employment interview in which it has been shown that there is little agreement among interviewers.[96] Lindquist points to the source of the letters of recommendation as limiting their usefulness because much depends upon the person writing the letters.[97]

Super claims that the occupational level of parents plays a part in determining vocational ambitions, in motivation, and in fixing financial resources upon which to draw.[98] Yet it is also true that a father's occupation may be the result of social stratification, circumstances, or environment rather than ability or personal characteristics. The vocational achievements of brothers and sisters as indicative of probable occupational level was found

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[94]Stuit, loc. cit., p. 6.

[95]Virginia Gregorius, "Characteristics of Students Who Withdrew from a Selected School of Nursing" (unpublished Master's thesis, University of Chicago, 1956).

[96]Donald E. Super and John O. Crites, Appraising Vocational Fitness by Means of Psychological Tests (New York: Harper and Brothers, 1962), pp. 20-25.

[97]E. F. Lindquist, (ed.), Educational Measurement (Washington: American Council on Education, 1951), p. 94.

[98]Donald E. Super, Appraising Vocational Fitness (New York: Harper and Brothers, 1949), p. 6.

significant in the Douglass study;[99] however, this Minnesota survey also showed that both the successful and the eliminated students came from the same socio-economic status, Group 3 as given on the Rulon Revision of the Minnesota Scale for Occupational Status.

A more recent study of student nurses, however, using as index of socio-economic ratings the occupation of fathers, reported that one-third came from families rated "lower," and one-third from families rated either "middle" or "higher." A comparison of the socio-economic background of the freshmen and seniors showed a decrease in the lower occupational rating group from 51.4 per cent to 44.3 per cent. The middle group seemed most stable and the evidence seems to point to the conclusion that the process of nursing education works in such a way that students coming from "middle" socio-economic populations are more likely to complete their education and find nursing education more congenial, satisfying, and desirable than do students from lower levels. The drop-outs themselves affirmed that marriage was a strong competitor with nursing as a career. The study also indicated that dislike for nursing is more likely to be a contributing factor rather than a precipitating cause.[100]

Other studies have investigated the size of high school attended as a factor in college success. A study of overachievers and underachievers at the University of Georgia concluded that overachievers tended to have been produced in smaller schools having smaller graduating classes. They also resided in

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[99]Harl R. Douglass and Ruth A. Merrill, "Predicting Success in the School of Nursing," University of Minnesota Studies in Predicting Scholastic Achievement (Minneapolis: University of Minnesota Press, 1942), p. 19.

[100]The American Nurses' Foundation, Inc., "Formal Education and the Process of Professionalization: A Study of Student Nurses," Part 5 of A Study of the Registered Nurse in a Metropolitan Community (Kansas City, Missouri: Community Studies, Inc., 1957), pp. 25-9.

small towns or rural areas before coming to the University.[101] Douglass and Merrill,[102] however, in their comparative study at the University of Minnesota of the successful and unsuccessful nursing students found that the graduates came from a graduating class of 50-99 whereas the eliminants came from a class of 20-49. Inconclusive evidence and general disagreement regarding the effect of size of school and college success are found in studies made by Boyd,[103] Bonner,[104] Lins,[105] Sanders,[106] Bledsoe,[107] and Hinds.[108]

Although Meehl[109] has furnished definitive synthesis of research on clinical vs. statistical prediction and holds to the point of view that the statistical approach is an economical substitute for a more clinical approach and

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[101]James F. Miller, Sr., "A Comparison of Overachievers and Underachievers at the University of Georgia," Dissertation Abstracts, 1958-59, XIX, Pt. 2, p. 1960.

[102]Douglass, loc. cit.

[103]Joseph Boyd, "The Relative Program Value with Relative Criteria in Predicting Beginning Academic Success at Northwestern University," Dissertation Abstracts, XV, p. 1955.

[104]Leon Bonner, "Factors Associated with the Academic Achievement of Freshmen Students at a Southern Agricultural College," Dissertation Abstracts, XVII, p. 1955.

[105]L. J. Lins, "Pre-University Background and Effect of Various Factors Upon University Success," Personnel and Guidance Journal, XXXIII (November, 1954), 157-8.

[106]Wilma Sanders, R. T. Osborne, and J. E. Greene, "Intelligence and Academic Performance of Urban, Rural, and Mixed Students," Journal of Educational Research, XLIX (1955), 185-93.

[107]Joseph Bledsoe, "Analysis of the Relationship of Size of High School to Marks Received by Graduates in First Year of College," Journal of Educational Sociology, XXVII (October, 1954), 414-18.

[108]Sister James Claudia Hinds, "Size and Type of High School as Factors in College Achievement" (unpublished doctoral dissertation, Loyola University, Chicago, 1962).

[109]P. E. Meehl, Clinical Versus Statistical Prediction (Minneapolis: University of Minnesota Press, 1954).

Kelly and Fiske[110] report that ratings based on the credentials files and objective tests alone were about as good as those based on much larger amounts of material, the author seeks to supplement the actuarial method of prediction in an effort to find clues about the type of person who withdraws or does not work up to potential. She will do this by an analysis and comparison of the personal data of those who were successful and of those who withdrew or failed. Can the various determinants of success, such as motivation, persistence, maturity, insight, personal adjustment, and past experiences at home, school and on the job be found by examining biographical data as furnished on the application form and in the interview and recommendation forms? This biographical data includes age of student, school attended, curriculum pursued, rank in class, indications of overachievement and underachievement, home background, work experience, and so on. Can differences in this experiential background data between the success group and the withdrawal-failure group be combined with the test information in constructing a profile of both kinds of candidates so that the admissions office can make more effective selection? This part of the study will be taken up in Chapter V.

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[110]Leona Tyler, The Work of the Counselor (New York: Appleton-Century-Crofts, Inc., 1953), p. 206.

CHAPTER III

THE DESIGN OF THIS RESEARCH

The Population Included in the Study

Eight classes of students were followed throughout their three-year course at St. Joseph's Hospital School of Nursing. Although 339 students were admitted during this period, 227 successfully passed the State Board examination after graduation without additional tutoring. Subtracting from this latter group those who did not take the NLN pre-entrance test and those whose records contained incomplete data needed in this study, the "success" sample consisted of 198 students. Data on this particular group was used in the statistical study of test validity. The "non-success" group, consisting of those who withdrew or failed, comprised 112 students. After eliminating those whose records were incomplete, this group was considered later in the study of withdrawals.

The Sources of Data

All data recorded in the files of the school of nursing were examined for pertinence and placed on file cards and forms. The cards were then sorted into two categories, the success group and the withdrawal-failure group.

Since intelligence test scores, rank-in-class, and/or high school average were missing on the high school transcripts of a number of students, a letter was sent to the respective high schools asking for such information if available. The principals responded one hundred per cent although several schools did not have the information on their records or had not given

intelligence tests to these particular students.

Some difficulty was encountered in obtaining comparable scores from the high school transcripts. It had been planned originally to use grade points in determining relationship between the high school and the school of nursing averages; however, the use of per cents appeared more feasible when a more detailed examination of the high school records revealed that, while the various high schools gave different numerical values to letter grades, the majority reported in numbers. Furthermore, a numerical grading system was in use at the school of nursing during the period under investigation. Accordingly, all student grades were converted to numbers, using the key to grading found on the transcripts. In most cases, the use of the midpoint gave the best approximation (unless plus and minus symbols were used), for in practically all cases the general average found in this way coincided with the general average submitted on the transcripts. General courses such as physical education, chorus, band, driver education, and those carrying less than one-half credit per term were not included in the final average or in total number of credits earned.

Rank-in-class data also presented a problem because the size of classes varied from 4 to almost 700. Comparable or equivalent scores seemed unobtainable. Rather than eliminate this variable entirely, it was decided to use the biserial r formula to calculate the coefficient although one realizes that there is some difference in the comparability of this statistic with the Pearson product-moment or zero-order coefficient, particularly when the size of the two categories varies considerably.

Because Stuit's[1] study recommended that individual prognosis would be more valuable if based upon a consideration of a combination of factors,

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[1]Stuit, loc. cit., p. 180.

including a person's previous scholastic record, results in nursing aptitude tests, and achievement tests in English, science, and elementary mathematics (included in the NLN battery), it was also decided to include high school grades in English, science, and mathematics in order to determine relationships between school marks in these specific areas and PNG test scores.

To make the reported IQ scores as equivalent as possible, recourse to equivalence tables of Engelhart[2] and Lennon[3] helped somewhat in converting IQ's to the Otis scale where possible. In the case of intelligence tests for which no equivalence table was available, the IQ as reported was used although the writer realized that this could make some slight difference in the validity coefficients to be computed.

The grades obtained in the school of nursing were based on written assignments, classroom participation, tests in the content subjects, and also on practical behavior on the floor in the clinical areas. To have separated these two grades—clinical and theoretical—would have been very valuable in our study. The two grades were generally combined before being recorded in the permanent record files, however, so that the cumulative folder did not yield the desired information. We attempted to ascertain, therefore, what difference there might be between first-year averages and final averages over the three-year program, insofar as the first year is spent chiefly in theory or content subjects, whereas the final average includes much technic or clinical work as well.

Initially it was planned to analyze the recommendations submitted by the applicants in order to check the predictive value of this type of information as

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[2]Max D. Engelhart, "Equivalence of Intelligence Quotients of Five Group Intelligence Tests," (Chicago: Bureau of Pupil Guidance, Chicago Public Schools). (Mimeographed.)

[3]Roger T. Lennon, "A Comparison of Results of Three Intelligence Tests," Test Service Notebook, No. 1 (New York: Harcourt Brace & World, Inc.).

part of the pre-entrance data. The 4 by 6 card, therefore, had blanks for recording recommendation data and for assigning a numerical value of 1, 2, or 3 to correspond to "do not endorse," "endorse," or "endorse with enthusiasm." Empirical evidence of all cards, however, indicated that the appraisals solicited from friends, neighbors, employers, and teachers were very much alike for all individuals and of very doubtful validity. Neither did a study of the character-traits check list reveal any differences that might provide clues to eventual withdrawal. In some cases, the person recommending honestly acknowledged his or her inability to accurately check certain areas listed and said that acquaintance with the girl was not close enough to justify evaluation of each trait. A brief statement on the high school transcript by the high school principal generally gave the best assessment of a student's integrity, citizenship, and scholastic ability. Until a more objective means of using a recommendation form can be obtained, this particular method of selecting applicants cannot be relied upon to furnish reliable and valid evidence. It was not deemed sufficiently trustworthy to include in the correlation study.

In addition to the information recorded on the cards for the statistical work of the validation study, other information available to the admissions office at the time of application and registration which might add predictive value in the later study of the withdrawal-failure group was also recorded.

The Method Used

Since the main part of this study was to analyze the predictive validity of the NLN PNG battery in this hospital school of nursing, coefficients of correlation were calculated. Although the NLN Evaluation Service sends both a raw score and a percentile score for each examinee, it was decided to use the raw scores in this study. The percentile technic provides valuable information

which can be used to interpret test performance in comparing one school with other diploma schools of nursing throughout the United States, but percentile scores have one important limitation: the scores cluster around a central point with a gradual tapering off in either direction. The farther a raw score ranges from the central point, the greater must be the change in the number of raw score points in order to change the percentile score; the farther a raw score is from the average, the smaller the number of raw score points needed to change the equivalent percentile score. Practically, this means that the percentiles toward the ends of the scale are much more stable than those near the middle. Equal arithmetical differences between two pairs of percentile scores do not necessarily indicate equal differences between corresponding pairs of raw scores. The percentile scale does not have equal units, or rather we cannot assume them so. Moreover, the percentiles listed on the profile are those of the national validation group, not those of a particular geographical area or of a particular school of nursing. Because of all these limitations, it was decided to use raw scores in the study.

Access to an IBM 1410 computer provided accurate calculations of the means, standard deviations, and Pearson product-moment coefficients of correlation. For this it was necessary to record the variables on an IBM tape.

The independent or predictor variables consisted of

1. The NLN battery:

    a. ACE total or T score;
    b. ACE linguistic or L score;
    c. ACE quantitative or Q score;
    d. Speed of reading score;
    e. Level of reading score;
    f. Natural science score;
    g. Mathematics score;
    h. History and social studies score;

2. The high school transcript data:

    a. High school average;
    b. High school average in English;
    c. High school average in science;
    d. High school average in mathematics;
    e. The IQ.

The dependent or criterion variables consisted of

1. The first-year average in the school of nursing;
2. The final average in the school of nursing;
3. The five scores obtained on the SBTP examination:

    a. Medical;
    b. Surgical;
    c. Obstetric;
    d. Pediatric;
    e. Psychiatric.

Altogether, 20 factors were considered. The NLN PNG also gives a composite or weighted score for the tests from 1954 onwards, but the formula has been changed several times on the basis of the correlations obtained in the different testing periods. Because of differences in derivations, therefore, the composite scores reported are not comparable and could not be included.

To find the relationship between rank in the high school class and the seven criterion variables, the biserial r formula was used. Students were categorized (1) above the class median and (2) at or below the class median. The sample consisted of 166 above the median and 32 below. Since the biserial r rests on the assumption of (1) continuity in the dichotomized trait; (2) normality of distribution; (3) a large N; and (4) a split that is not too extreme,[4] there was some doubt about this last point being met.

It was also hoped that the same 1410 computer would furnish the regression coefficients, the multiple correlation coefficients, and the amount of variance contributed by each variable; however, the machine program was set up

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[4]Henry E. Garrett and R. S. Woodworth, Statistics in Psychology and Education (New York: Longmans, Green and Company, Inc., 1958), p. 380.

for one dependent variable rather than for the seven with which we were concerned. Thus the information so provided was not usable. It did, however, point up one significant fact: in computing the variance contributing to the final average, the computer immediately selected the T score and discarded the L score on the ACE examination, indicating thereby that the T score reduces the variance the most in a single iteration and the L score could not cause further reduction in variance. As explained by Efroymson, ". . . when an independent variable is approximately a linear combination of other independent variables . . . if the multiple correlation coefficient between a number of so-called independent variables is so large that most of the variability in one independent variable is related to the other independent variables, this variable will not be placed in the regression."[5] Moreover, the L score is actually a part of the T score.

The writer decided to employ the DuBois method of multivariate correlational analysis. Interest in this technique stemmed from the practical advantages derived therefrom. The multiple R can be readily computed by reduction of criterion variance. At any stage, the variable making the greatest contribution to the multiple can be identified, and in this selection process variables which duplicate the function of variables already chosen tend to drop out. Starting with the factor exhibiting the highest correlation with the criterion variable and adding in succession the next highest factors which have at the same time low coefficients of correlation with each other, one can determine the advantage of eliminating certain independent variables. Often a limited number of variables so selected will have a multiple almost as high as that of the total group

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[5]Anthony Ralston and Herbert Wilf (eds.), Mathematical Methods for Digital Computers (New York: John Wiley and Sons, Inc., 1960), p. 194.

of predictors.[6] Moreover, most of the calculations can be performed on a calculator with speed and precision and adjustments can be made so that the variable or variables that will make the greatest contribution to the multiple will be utilized to full advantage.[7] In addition, the method simplifies the computation of the beta coefficients needed in the regression equation.

In the DuBois method, the final matrix consists of one element, the partial variance of the dependent variable remaining after the variance associated with other variables has been subtracted. From this the multiple R can be readily computed by the formula $R^2_{0(12...n)}=1-V_{0.12...n}$. Thus, solution is reached by reduction of criterion variance. Any beta of the required order can also be simply and routinely found by taking the beta on the criterion line and subtracting from it the product of the pairs of betas present. From the complete set of betas we have the regression equation in z-score form and then merely substitute for each z its equivalent: $\frac{X-Mx}{S.D.x}$.[8] Furthermore, each b-weight is the beta times the standard deviation of the criterion, divided by the standard deviation of the predictor. And the constant factor is the mean of the criterion less the sum of the products of each predictor mean and the ratio of the standard deviation of the criterion and predictor. Thus, by this method it is relatively simple to construct a regression equation useful for predicting individual scores.

In order to test the value of the regression equation so obtained, several students' data cards were selected randomly from the sample. Predicted scores were determined from the raw scores contained thereon.

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[6]Philip DuBois, Multivariate Correlational Analysis (New York: Harper, 1959), p. 36.

[7]Ibid., pp. 16-17.

[8]Ibid., pp. 22-27.

Further investigation of the withdrawal-failure group in the light of this test data and also through a study of experiential background was made by a comparative analysis with the success group. Characteristics as recorded in the cumulative folders were examined and a modified case-study approach by means of a profile was used in a subjective, clinical evaluation in which both scholastic and non-scholastic factors were combined. In this way, the author hoped to find other trait factors that had an influence on interest, motivation, persistence, particularly in the borderline cases and with those who had difficulty in adjusting. It was recognized that many unknown factors often encourage or discourage a student in attaining her goal.

Although there are many types of information that could be utilized in any survey of educational and social background of students, the writer's purpose was to limit this factual data to that found on the application blank, the high school transcript, and the interview. The following items were chosen for scrutiny and comparison:

1. Educational background

    a. Number of units taken in high school
    b. Averages in high school--general, English, science, mathematics
    c. Rank in high school class (above or below median)
    d. IQ as recorded on transcript
    e. High School curriculum pursued
    f. Size of high school attended
    g. Indication of overachiever or underachiever
    h. PNG total raw score

2. Family background

    a. Place of residence--urban or rural
    b. Size of family, place in group
    c. Education and occupation of father
    d. Education and occupation of mother (before and after marriage)
    e. Work experience of candidate

These data will be examined in Chapter V.

CHAPTER IV

RESULTS AND INTERPRETATION

General Overview

Table 1 on the following page gives the Pearson product-moment coefficients of correlation between the 13 independent variables, the 7 dependent variables, and all the possible intercorrelations from the sample of 198 successful students in the school of nursing. Table 2 shows the biserial coefficients of correlation between rank in class and the seven criterion variables.

TABLE 2

COEFFICIENTS OF CORRELATION BETWEEN RANK IN CLASS AND HIGH SCHOOL AVERAGE AND SEVEN CRITERION VARIABLES

	SBTP Examination					Nursing School	
	Medical	Surgical	Obstetric	Pediatric	Psychiatric	1st Year Aver.	Final Average
Rank in class (biserial)	.343	.447	.172	.290	.347	.742	.667
High school average (product-moment)	.416	.430	.331	.340	.273	.696	.678

For the purpose of comparison, the table also includes the product-moment coefficients for high school average and the criteria. Because biserial r is not

TABLE 1

COEFFICIENTS OF CORRELATION BETWEEN PREDICTOR AND CRITERION VARIABLES

Variable		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ACE Total Raw Score	(1)	---	826	915	693	536	526	663	446	475	504	502	403	434	543	562	423	447	346	525	399
ACE Quantitative	(2)	826	---	529	421	256	527	400	193	315	368	287	254	429	424	402	307	270	163	361	279
ACE Linguistic	(3)	915	529	---	742	625	415	712	534	490	496	550	424	347	514	559	418	480	404	532	402
Reading: Speed	(4)	693	421	742	---	825	368	597	510	291	410	406	220	229	419	423	389	418	438	407	266
Reading: Level	(5)	536	256	625	825	---	318	569	470	302	369	409	248	240	440	441	423	425	425	449	324
Math Test	(6)	526	527	415	368	318	---	403	300	494	413	464	369	553	373	381	249	266	187	443	436
Natural Science Test	(7)	663	400	712	597	569	403	---	575	461	385	478	393	313	463	457	333	421	343	511	390
History & Soc. Studies Test	(8)	446	193	534	510	470	300	575	---	430	339	449	381	212	323	207	243	230	246	369	312
High School Average	(9)	475	315	490	291	302	494	461	430	---	395	893	833	758	416	430	331	340	273	696	678
High School IQ	(10)	504	368	496	410	369	413	385	339	395	---	412	321	341	276	313	227	301	274	314	284
High School Engl. Average	(11)	502	287	550	406	409	464	478	449	893	412	---	759	639	373	423	327	301	328	650	608
High School Science Average	(12)	403	254	424	220	248	369	393	381	833	321	759	---	623	350	369	262	293	259	641	612
High School Math. Average	(13)	434	429	347	229	240	553	313	212	758	341	639	623	---	364	363	307	269	199	557	533
SBTP - Medical	(14)	543	424	514	419	440	373	464	323	416	276	373	350	364	---	680	654	633	486	562	467
SBTP - Surgical	(15)	562	402	559	423	441	381	457	207	430	313	423	369	363	680	---	600	629	499	538	482
SBTP - Obstetric	(16)	423	307	418	389	423	249	333	243	331	227	327	262	307	654	600	---	592	387	510	453
SBTP - Pediatric	(17)	447	270	480	418	425	266	421	230	340	301	301	293	269	633	629	592	---	526	436	405
SBTP - Psychiatric	(18)	346	163	404	438	425	187	343	246	273	274	328	259	199	486	499	387	526	---	403	362
1st Year Nursing Average	(19)	525	361	532	407	449	443	511	369	696	314	650	641	557	562	538	510	436	403	---	880
Final Nursing School Average	(20)	399	279	402	266	324	436	390	312	678	284	608	612	533	467	482	453	405	362	880	---

All decimal points omitted. Fourth-place coefficients were rounded to three places to conserve space.

limited to a range of 1.00, as is the Pearson r, comparison with the other coefficients is difficult. At best, biserial r gives only an estimate of the product-moment r to be expected.[1] Therefore, it was thought best not to include the biserial coefficients indiscriminately with all the others.

Before analyzing any of these relationships, it should be pointed out that for a sample of this size a coefficient should reach .140 to be significant at the 5 per cent level of confidence and .183 to be significant at the 1 per cent level.[2] Furthermore, the reader must bear in mind that the value of r and its significance for predictive purposes cannot be simply and absolutely stated. Such factors as homogeneity within the group, reliability of the measurements used, size of the sample, other sampling factors, and the purpose for which the index is employed must be considered in determining the usefulness of the coefficient obtained. What would be a large coefficient for one purpose, would be regarded as a small one for another. Interpretation, therefore, is largely a relative matter. How much faith should be placed in any relationship shown by a coefficient of correlation depends also upon the urgency of the outcome. Moreover, coefficients computed between the same two variables will vary not only from sample to sample but also from population to population. Finally, the significance of an r, with respect to predictive value, should be gauged by the size of the standard error of estimate.[3]

An analysis of the coefficient furnishes some meaningful and interesting observations. All coefficients fell within the 5 per cent level of signifi-

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[1]Garrett, loc. cit., p. 380.

[2]The reader may refer to tables in Guilford, J. P., Fundamental Statistics in Psychology and Education (New York: McGraw-Hill Book Company, Inc., 1956), p. 539.

[3]Ibid., pp. 145-147.

cance; all but two—the coefficient derived from the ACE Q score and State Board psychiatric examination and the biserial r from high school rank and the State Board obstetric examination—reached the 1 per cent level; however, some are much more significant than others, as reference to the preceding tables reveals. It is quite probable that if the investigator could have included the entire group of examinees who took the NLN PNG, regardless of whether or not they had been accepted in the program, that a higher correlation coefficient would be obtained. As it is, the selection and elimination process diminished the range of scores, thus restricting the prediction.

Relationships Between Predictor and Criterion Variables

No single predictor variable had highest correlation with all criterion variables. Relationships between the predictor or independent variables and the criterion or dependent variables showed varying degrees of strength. Although the high school average correlated highest with both first-year and final grades in the school of nursing (.696 and .678 respectively), its relationship with the five areas of the SBTP examination varied from .430 with the surgical to .273 with the psychiatric. This latter coefficient is somewhat below an r that would be helpful in prediction. The ACE T and L scores appeared to be most predictive of success on the SBTP examinations, except in the psychiatric area where the two reading tests showed higher relationships. Table 3 presents a graphic illustration.

As individual criterion variables, the SBTP tests seem unstable because the relationships with each predictor vary in significance. A re-grouping of the coefficients in which we list the five highest and the five lowest predictor variables in order does exhibit, however, a similarity with all criterion variables. This pattern can be seen in Table 4.

TABLE 3

COEFFICIENTS OF CORRELATION BETWEEN PREDICTOR AND CRITERION VARIABLES

Predictor Variables	SBTP Examination					Nursing-School Averages	
	Medical	Surgical	Obstetric	Pediatric	Psychiatric	1st Year Aver.	Final Average
ACE T (Raw Score)	543	562	423	447	346	525	399
ACE Q (Raw Score)	424	402	307	270	163	361	279
ACE L (Raw Score)	514	559	418	480	404	532	402
Speed of Reading Test	419	423	389	418	438	407	266
Level of Reading Test	440	441	423	425	425	449	324
Mathematics Test	373	381	249	266	187	443	436
Natural Science Test	463	457	333	421	343	511	390
History & Social Studies Test	323	207	243	230	246	369	312
High School IQ	276	313	227	301	274	314	284
H. S. English Average	373	423	327	301	328	650	608
H. S. Science Average	350	369	262	293	259	641	612
H. S. Mathematics Average	364	363	307	269	199	557	533
H. S. General Average	416	430	331	340	273	696	678

(All decimal points have been omitted in the coefficients.)

TABLE 4

HIGHEST AND LOWEST COEFFICIENTS

Surgical		Medical		Obstetric		Pediatric	
(Highest)		(Highest)		(Highest)		(Highest)	
ACE T	562	ACE T	543	ACE T	423	ACE L	480
ACE L	559	ACE L	514	Reading Level	423	ACE T	447
Science Teat	457	Science Test	463	ACE L	418	Reading Level	425
Reading Level	441	Reading Level	440	Reading Speed	389	Reading Speed	418
High S. Aver.	430	ACE Q	424	Science Test	333	Science Test	421
(Lowest)		(Lowest		(Lowest)		(Lowest)	
Hist. & S. S.	207	IQ	276	IQ	227	Hist. & S. S.	230
IQ	313	Hist. & S. S.	323	Hist. & S. S.	243	Math. Test	266
H.S. Math. Av.	363	H.S. Science	350	Math. Test	249	ACE Q	270
H.S. Science	369	H.S. Math. Av.	364	H.S. Science	262	H.S. Math. Av.	269
Math. Test	381	Math. Test	373	H.S. Math. Av.	307	H.S. Science	293

Psychiatric		1st Year Average		Final Average		
(Highest)		(Highest)		(Highest)		
Reading Speed	438	H.S. Gen. Av.	696	H.S. Gen. Av.	678	(N.B. Coefficients of correlation between H. S. English Average, Science Average, Mathematics Average, and 1st Year and Final Averages were 2d, 3d, & 4th highest but were omitted for reasons stated in the discussion that follows.)
Reading Level	425	ACE L	532	Math. Test	436	
ACE L	404	ACE T	525	ACE L	402	
ACE T	346	Science Test	511	ACE T	399	
Science Test	343	Reading Level	449	Science Test	390	
(Lowest)		(Lowest)		(Lowest)		
ACE Q	163	IQ	314	Reading Speed	266	
Math. Test	187	ACE Q	361	ACE Q	279	
H.S. Math. Av.	199	Hist. & S. S.	369	IQ	284	
Hist. & S. S.	246	Reading Speed	407	Hist. & S. S.	312	
H.S. Science	259	Math. Test	443	Reading Level	324	

NOTE: All decimal points have been omitted in the coefficients.

The ACE T and L scores and the Natural Science and Level of Reading scores rank among the highest on all the SBTP examinations as well as on the first-year average in the school of nursing; while the History and Social Studies Test, the IQ, and the high school science and mathematics averages and the PNG Mathematics Test are among the lowest ranking with the same criterion variables. The high school average, however, ranks among the top five only with the surgical area and the two averages in the school of nursing. The Speed of Reading Test is listed among the top five with the obstetric, pediatric, and psychiatric areas; the ACE Q score only with the medical area. Conversely, the Q score coefficients rank among the lowest in nearly all other areas. The Mathematics Test shows a strong relationship only with the final average in the school of nursing.

Although the high school English, science, and mathematics averages have higher correlations with both first-year and final averages in the school of nursing than do any parts of the NLN battery, they do not show up as well as the general average. To use one or more of these with the general average would include some spurious correlation. The intercorrelations within these subject averages, as noted in Table 1, are quite high.

When used individually, the ACE T and L scores correlated with the surgical and pediatric tests and the reading tests correlated with the psychiatric tests seem somewhat more predictive than do the high school averages; however, the lower coefficients in the latter case may be due in part to the more restricted range in the averages obtained in the nursing program. For example, averages in the first year ranged from 73 per cent to 96 per cent, but the great majority of averages clustered in the 82 to 93 range, with only fractional parts separating most of them. Moreoever, it is to be expected that a test will correlate more highly with another test than with teachers' marks because of their

common limitations of sampling performance. The highest coefficient obtained from the SBTP examination and specific subject areas in high school comes from the English average although the difference is very slight.

Table 3 also reveals the higher correlations that exist between all predictor variables and first-year averages in the school of nursing than with the final averages therein. This is in line with practically all previous studies and is generally explained by the proximity of the pre-entrance test to the first-year average. There is, however, less fluctuation in the coefficients when comparing first-year and final grade averages in the school of nursing with the high school averages and the IQ than when comparing the SBTP scores with these high school averages and IQ. Can this be caused by subjectivity in the marking system or to similarity of the numbers involved in marking percentage-wise?

A rather striking feature is that the first-year averages correlate better with the SBTP tests than do the final averages with the SBTP. This, however, follows the finding of Hartigan in his correlation study of freshman, sophomore, junior, and senior grade averages with the National Merit Scholarship Examination and with the California Test battery. Freshman averages proved to be more accurate predictors of success than did the averages of the other high school years.[4] Higher motivation at this period in the student nurse's career and fewer extraneous influences may explain this phenomenon in part. Another hypothesis is that, as suggested in the introduction, the first-year grade may represent more theory and content subjects whereas the final grade includes a great deal of clinical practice. If the latter is true, the SBTP examination

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[4]Daniel J. Hartigan, "Some California Test Bureau Measures Predictive of Ninth Grade and Eleventh Grade Academic Achievement" (unpublished doctoral dissertation, Loyola University, Chicago, 1962), pp. 73-4.

may well represent what the student knows rather than what she puts into practice on the floor. In other words, the SBTP examination may not be too valid as a criterion of "success on the job."

In spite of the variations between the independent variables and the criterion variables, Table 4 does emphasize a pattern that is observable in regard to the five lowest-ranking variables with all criteria. The ACE Q scores, the Mathematics Test scores, and the History and Social Science Test scores in descending order show weakest relationship with all criteria. Strangely, too, the high school IQ shows low correlation with all dependent variables.[5] Most of the independent variables show lower relationships with the psychiatric and obstetric areas than with the medical, surgical, and pediatric; yet when we consider the means of the scores in the five areas, the psychiatric has the higher (530.04) while medical and surgical have the lowest (491.18 and 493.47). A look at their standard deviations seemingly indicates a more normal grouping or cluster of scores, a better distribution for the medical and surgical areas and a greater range. The upward trend and the narrowing of the dispersion noted in the psychiatric area indicates a narrowing of the spread among the examinees in this area.

The high coefficients of correlation between the Natural Science Test and the first-year average (.511) as compared with the coefficients obtained with the final average (.390) may be due in part to the fact that the science courses in the school of nursing occur chiefly in the first year. What is more difficult to explain is the relative stability of the coefficients of correlation between the Mathematics Test and the first-year and final averages in the

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[5]Hartigan found IQ as measured by the California Short Form Test of Mental Maturity a highly significant factor in scholastic achievement as indicated by Freshman Grade Average in high school and on the National Merit Scholarship Qualifying Test. Ibid., p. 111

school of nursing. The Mathematics Test is the only one that showed coefficients of about the same degree with first-year and final averages in the school of nursing.

Intercorrelations of Independent Variables

NLN Battery.--Since the writer was primarily interested in the predictive validity of the NLN PNG battery, an examination of its intercorrelations reveals that these are high, too high for maximum validity, in fact. As Guilford points out, the best combination of predictive variables includes those that have high coefficients of correlation with the criterion and low intercorrelations with each other.[6] The following table does not reveal any really low intercorrelations.

TABLE 5

MATRIX OF INTERCORRELATIONS OF TEST BATTERY

	2	3	4	5	6	7	8	Mean	S.D.
1. ACE T raw score	826	915	693	536	526	663	446	97.17	19.83
2. ACE Q raw score		529	421	256	527	400	193	38.00	9.40
3. ACE L raw score			742	625	415	712	534	59.16	13.18
4. Reading Speed				825	368	597	510	53.46	7.54
5. Reading Level					318	569	470	53.59	6.11
6. Mathematics						403	300	33.55	9.71
7. Natural Science							575	56.33	5.54
8. Hist. & Soc. Stud.								17.95	9.92

(All decimal points have been omitted in the coefficients.)

[6]Guilford, loc. cit., p. 401.

The ACE T score has the lowest intercorrelation with the History and Social Studies Test, but even this is somewhat higher than one would desire. The ACE Q also has very low intercorrelation with the History and Social Studies Test, but the ACE Q and the History and Social Studies Test do not seem to be very meaningful in relation to the criterion variables. Speed of Reading and Level of Reading both have low correlations with the Mathematics; but again, mathematics (in our sample at least) seems to have low relationship with the criterion variables.

The high intercorrelations between the T and the L scores, between T and Speed of Reading, and between T and the Natural Science Test suggest that these tests are either measuring the same thing or that which makes up the content of the ACE also appears to be a strong factor or common element in the Reading and Science Tests. Because the ACE T includes the Q score, the T therefore correlates rather highly also with the Mathematics Test.

The ACE L scores correlate more highly with the Speed of Reading Test scores than with the Level of Reading scores, again indicating that the Speed of Reading Test measures something included with scholastic aptitude as measured by the ACE. The high intercorrelation of the L score with the Natural Science Test score also poses another question. Is the Natural Science Test based as much on verbal aptitude as on other more specialized information that one might expect to be included under science? If the former is true, a combined science-reading test might be a more economical and valid instrument. Moreoever, the Speed of Reading Test correlates highly with the Level of Reading Test and quite highly also with the Natural Science Test; thus strengthening the supposition that what is being measured by the reading tests also enters strongly in the scores made on the Natural Science Test. Apparently there is quite an overlap in the variance associated with several of these tests although it may be difficult to

separate some of these components.

Low intercorrelations are found between the ACE Q scores and the History and Social Studies Test, between the History Test and the Mathematics Test, between the Q score and the Level of Reading Test, between the Mathematics Test and the Level of Reading, and between the Mathematics Test and Speed of Reading Test. The latter test correlates slightly higher with all tests of the battery than does the Level of Reading Test; but the opposite is true when comparing the relationships between independent variables and criterion variables, except in the psychiatric area. Unfortunately, these low intercorrelations occur only within tests that do not seem particularly useful with the criterion variables, however.

Intercorrelations within the high school record data.—The reader can analyze the data as set up in the following table:

TABLE 6

	2	3	4	5	Mean	S.D.
1. High School Average	.395	.893	.833	.758	88.19	4.10
2. High School I.Q.		.412	.321	.341	108.29	8.49
3. High School Eng. Average			.759	.639	88.81	4.49
4. High School Science Average				.623	86.63	5.77
5. High School Math. Average					85.74	5.88

The highest intercorrelation coefficient within the record data variables is the r of .907, representing the relationship between high school rank and high school average. This is a highly significant one, yet one might expect an even stronger relationship to exist. The fact that a number of high school

classes were very small may account for the lower figure. Furthermore, since this is a biserial r coefficient, it cannot properly be used in a regression equation[7] nor can it be comparably equated with a product-moment coefficient, strictly speaking. Because of this and because the high school average appears more stable, the coefficient derived from rank-in-class will not be considered in our problem hereafter. There is no need for both.

Understandably, too, the high school general average correlates highest with the high school English average; but the correlation is also very significant between the high school science average and also with the mathematics average. This high relationship existing between the general average and each subject average is influenced by the fact that the general average includes the average obtained in each subject and therefore would be considered spurious.

The high school science and English averages show a strong relationship to each other in this study, and it seems rather remarkable that the high school mathematics average should correlate so well with the English average. In fact, there is a higher coefficient of correlation representing the English-mathematics relationship than for the mathematics-science relationship. These substantial intercorrelations may indicate a great deal of overlapping of common factors and perhaps the "halo effect" as well as the subjectivity of teachers' marks; for the intercorrelations between the high school marks and the achievement tests in the NLN battery show much lower relationships, as can be seen in Table 1.

In this study, the slight relationship that appears to exist between the high school IQ and the criterion variables is also evident in the intercorrela-

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[7]Garrett, loc. cit., p. 380 states that the biserial r has no standard error of estimate and the score predicted for all members of the group is simply the mean of the category.

tions between the IQ and the general and subject averages in the high school. Particularly surprising is the low r of .321 between high school science and the IQ as well as the fact that the r between IQ and the English average is higher than the r between IQ and the general average. The fact that these IQs were derived from various intelligence tests (although an attempt was made to make them equivalent) and that they were administered at various times in the students' high school career possibly account for the lower-than-expected coefficients.

Intercorrelations within the test battery and the high school data.— High intercorrelations between the high school English average and the science average, between the English and the mathematics average, between the mathematics average and the science average, as noted in the preceding section, and the lower intercorrelations between these averages and various parts of the test battery give support to the lack of agreement between marking systems and standardized test scores. Reference to Table 1 also reveals that the highest intercorrelations are between the high school mathematics average and the Mathematics Test and between the English average and the ACE L scores. The Mathematics Test, however, is ninth grade level so that it is possible for the average applicant without a strong high school mathematics background to do as well on the test as she did in high school even though she elected general or business mathematics rather than algebra and geometry. There is a rather marked relationship present between mathematics average and the ACE Q although the relationship of the mathematics average with the T score is just as substantial. The correlation between science average and the Natural Science Test is low. The ACE L score correlates to a greater degree with the science average. One might also expect a better correlation between the Q score and the science and mathematics averages in high school. The courses in high school science, however,

included general and introductory courses which did not require as strong a mathematics background or aptitude as did the more advanced courses in chemistry and physics of the college preparatory curriculum. Moreoever, some students took only one science course. These factors probably influence these results and lower the relationships.

More substantial relationships within the test battery and the high school record data consistently appear between the English average and the various sub-tests. Low relationships appear particularly between the mathematics and science averages. One might have expected lower relationships between the mathematics average and the History and Social Studies Test and between the mathematics average and Speed and Level of Reading Tests; yet the negligible relationship between science average and ACE Q is worthy of note. Since the History and Social Studies Test shows low relationship with criterion variables, it seems to be of slight use in the battery.

The ACE Psychological Examination and the two reading tests correlate higher with the IQ as recorded on the high school transcript than they do with high school averages, general or in specific subjects, suggesting that the aforementioned reading tests in the NLN battery may be measuring scholastic aptitude as much as or more than achievement. Such occurrences lead one to concur with the present-day trend of thought that achievement cannot be separated from aptitude or vice versa. Again, there is also the probability that teachers' marks have more than a degree of subjectivity. Since the ACE is also a measure of scholastic aptitude, one expects substantial relationships between this instrument and the high school IQ score. The r of .504 between IQ and the ACE T score and the r of .496 between the IQ and the ACE L score are fairly substantial, yet one would expect to find somewhat stronger relationship existing. It can be noted that the Speed of Reading Test is more aligned with IQ than is

the Level of Reading Test. This factor also appears when comparing the ACE with both reading tests—Speed of Reading shows stronger relationship than does the Level of Reading Test. One would also hope for more substantial correlation between IQ and the Natural Science Test. High School mathematics average appears to be as good as the Mathematics Test, irrespective of the type of mathematics courses taken in the high school; yet the ACE Q score correlates somewhat better with the Mathematics Test than with the high school mathematics average. Since the high school mathematics average is as useful as the Mathematics Test, one questions the advisability of administering the Mathematics Test, particularly if it can be shown that mathematics itself contributes little in the combination of variables to be later used in the regression formula. It is also interesting to note that the coefficients derived from the high school English average and all tests in the battery, excepting the ACE Q and the Mathematics Test, are slightly higher than those calculated between the high school general average and the test battery. This probably indicates a preponderance of the verbal factor in all of the tests.

Intercorrelations Within Criterion Variables

Within criterion variables, the highest intercorrelations understandably occur between first-year and final averages. This coefficient of .880 is only a little lower than the intercorrelation coefficient of .915 between the ACE T and L scores. Within the SBTP examination scores, the coefficients present some interesting patterns as Table 7 graphically reveals. One observes that substantial relationships exist between medical and surgical areas and between medical and obstetric, whereas slight relationship exists between obstetric and psychiatric. These coefficients perhaps indicate, among other things, the naturally close relationships between medical-surgical and the differences in psychiatric

techniques and content from other nursing areas. The lowest coefficients consistently are found in the psychiatric area. Incidentally, the lowest r in the pediatric field is also the highest r in the psychiatric. The fact that the psychiatric examination has a much higher mean also suggests that stronger emphasis in the nursing curriculum may be a factor in the differences. In short, there is a marked relationship among all areas of the SBTP examination with the exception of the psychiatric area. The first-year average in the school of nursing shows a somewhat stronger relationship with all SBTP areas than does the final average.

TABLE 7

INTERCORRELATIONS WITHIN CRITERION VARIABLES

	1	2	3	4	5	6	7	Mean	S.D.
1. Medical	-	680	654	633	486	562	467	491.18	78.65
2. Surgical	680	-	600	629	499	538	482	493.47	78.92
3. Obstetric	654	600	-	592	387	510	453	506.19	75.91
4. Pediatric	633	629	592	-	526	436	405	509.16	74.90
5. Psychiatric	486	499	387	526	-	403	362	530.04	72.13
6. First Year Av.	562	538	510	436	403	-	880	86.05	4.01
7. Final Av.	467	482	453	405	362	880	-	86.87	3.14

(All decimal points have been omitted in the coefficients.)

Summary of Relationships

First-year average in the school of nursing shows more significant relationships with the independent variables and with the SBTP examination than does the final average. It shows substantial relationship with those variables that

appear to be most important in the setting up of a prediction equation, the high school average, the ACE T and L scores, the reading tests' scores, and the science scores. Furthermore, since each section of the State Board Test varies in the strength of its relationship with the independent variables, the author deemed the freshman average to be the best criterion measure for practical use. Although some studies have used the SBTP composite for correlation purposes, since the examinee must pass each test separately with a minimum score of 350 or 400, according to state specifications, resort to this additive score seems less valid. In fact, on a trial run, the use of this composite score teamed with an additive composite on the NLN PNG gave a coefficient of only .038 for this sample. Furthermore, since most failures occur during the first year, this fact also contributed to the decision to use the first-year average as the dependent variable.

Use of the IQ as a predictor variable seemed to be of negligible value in this sample population. Although rank in high school class produced a coefficient of .742 with the first-year average and .667 with the final average in the school of nursing, compared with coefficients of .696 between high school average and first-year average in the school of nursing and .678 between high school average and final average, the relationship of rank with the SBTP examination appeared more uncertain and unstable than did those between high school average and the SBTP. For these reasons, it was decided to use the high school average combined with the NLN PNG tests as predictor variables in constructing the multiple R and a regression equation. Furthermore, setting up five different equations for use with the SBTP criterion seemed impractical, particularly in view of the rather low correlations and of the large error of estimate due to the large standard deviation.

Results of Multiple Correlation

Although the writer, for the reasons stated above, decided to use the freshman average in the school of nursing as the criterion variable in determining the regression equation according to the DuBois multivariate analysis scheme, she also experimented with the various other criterion measures to see what, if any, two-test combinations might be used advantageously to furnish the "best fit" with each criterion measure, hoping to find a short-cut or minimum battery which might compare favorably with a longer one. Because of the high intercorrelations within predictor variables, there was some doubt as to the relative combined value of several variables that separately showed high correlation with criterion variables. For example, by combining high school average and the Level of Reading Test, both of which had varying degrees of correlation with all criterion variables, would the weighting factor in the combination lead to more equal R's among the seven criterion variables? Or would a combination of the ACE T score and the Level of Reading applied to each criterion offer a sufficiently substantial R in all areas of the SBTP particularly? How would the various correlations and intercorrelations affect the size of R so that optimal strength could be judged? Knowledge of these influences would be of some assistance, moreoever, in the choice of variables in a five or six variable combination or selection of a test battery. In manipulating two independent variables with each criterion variable the following formula was used:

$$R^2_{1.23} = \frac{r^2_{12} + r^2_{13} - 2(r_{12})(r_{13})(r_{23})}{1 - r^2_{23}}$$

The following multiple coefficients are given for means of comparison so that the reader may observe the similarities and differences among the various combinations of independent and dependent variables.

TABLE 8

MULTIPLE CORRELATIONS AMONG THREE VARIABLES, INCLUDING ONE INDEX OF SUCCESS AND TWO PREDICTIVE INDICES

Predictor Variable	Criterion Variable	Multiple R
High Sch. Av. (.696), Read. Lev.[a] (.449)	First Year Average	.7399
High School Average, ACE T (.525)	" " "	.7307
High School Average, ACE L (.532)	" " "	.7282
High School Average, IQ (.314)	" " "	.6967[b]
High Sch. Math. Av. (.557), ACE L	" " "	.6639
ACE L, Mathematics Test (.443)	" " "	.5853
ACE T, Natural Science Test (.511)	" " "	.5684
ACE L, Natural Science Test	" " "	.5661
High Sch. Av. (.678), Read. Lev. (.324)	Final Average	.6895
High Sch. Av., Math. Test (.436)	" "	.6880
High Sch. Av., ACE T (.399)	" "	.6837
High Sch. Av., N. Science Test (.390)	" "	.6833
High School Average, ACE L (.402)	" "	.6827
High School Average, IQ (.284)	" "	.6782
ACE L (.402), Mathematics Test (.436)	" "	.4991
ACE T (.399), Natural Science Test	" "	.4327
High Sch. Av. (.430), ACE T (.562)	SBTP—Surgical	.5917
ACE T, Reading Level (.441)	" "	.5856
ACE T, Natural Science Test (.457)	" "	.5731

[a]Simple coefficients are listed where necessary to help the reader identify the amount of change when another variable is added.

[b]An increase of only .0006 points to the high school average taken alone.

TABLE 8—Continued

Predictor Variable	Criterion Variable	Multiple R
High School Av. (.416), ACE T (.543)	SBTP—Medical	.5720
ACE T, Reading Level (.440)	" "	.5710
High Sch. Science Av. (.350), ACE T	" "	.5611
ACE T, Natural Science Test (.463)	" "	.5601
ACE L (.514), Mathematics Test (.373)	" "	.5431
High School Science Av., Science Test	" "	.4980
Reading Level, Reading Speed (.419)	" "	.4512
ACE T (.423), Reading Level (.423)	SBTP—Obstetric	.4882
High Sch. Av. (.331), Reading Level	" "	.4772
High Sch. Av., ACE T	" "	.4481
ACE L (.480), Reading Level (.425)	SBTP—Pediatric	.5059
ACE T (.447), Reading Level	" "	.4981
ACE L, High School Average (.340)	" "	.4949
ACE T, High School Average	" "	.4698
Read. Speed (.438), Eng. Av. (.328)	SBTP—Psychiatric	.4678
Reading Level (.425), ACE L (.404)	" "	.4603
Reading Speed, ACE L	" "	.4536
Reading Level, ACE T (.346)	" "	.4474
Reading Level, IQ (.274)	" "	.4433
ACE T, English Average	" "	.3597

According to the results obtained when using the first-year average in the school of nursing as the criterion variable, the high school average and the Reading Level Test taken together give the highest coefficient for this sample (.7399) followed by the ACE T score and high school average (.7307). Using individual tests from the NLN PNG battery only, surprisingly, the L score and the Mathematics Test score produce the highest two-variable combination, with a multiple coefficient of .5853, followed by the ACE T and Science Test coefficient of .5684.

The coefficients of correlation between the final average in the school of nursing and two-variable combinations of predictor indices indicate that the highest coefficient again is obtained when using the high school average and Reading Level Test score--.6895; second place in degree of relationship occurs in this instance with high school average and the Mathematics Test. Because the Mathematics Test coefficient remained stable over the three-year period while others decreased in size, a stronger multiple R emerged in this combination. In combining parts of the test battery only, the ACE L score and the Mathematics Test score again exhibit the best multiple coefficient with an R of .4991, a drop of .1862 points from the first-year average as criterion. Although the R of .6895 between high school average, Reading Level, and final average appears to be much more significant than the R of .4991 between ACE L, Mathematics, and final average, one must remember that it is not the addition of the second variable that strengthens the relationship but the single variable of high school average with its coefficient of .678. In the second instance, however, in judging the relative contributions of the individual tests, the addition of ACE L (.402) to the Mathematics Test coefficient (.436) increases the multiple coefficient to .499.

One can readily see that the IQ contributes little or nothing when added to any of the predictor variables in this sample when using grade averages in the school of nursing as criterion variables. Although Speed of Reading and Level of Reading scores show consistently substantial relationships with six criteria (except final average), their high intercorrelations prevent their use in a two-variable combination; however, their use in a multi-variable equation may subsequently be shown to be of value.

Perusal of the five areas of the SBTP examination led to the conviction that, taken together, the Level of Reading, the high school average, and the ACE T scores would make the most valuable combination in four of the areas. The use of two variables only would cause slight changes in position of the two most important measures. The psychiatric area posed something of a problem because of its dissimilarity to the others. Here, Speed of Reading and high school English average rather than Level of Reading and general average gave the highest coefficients of correlation, followed by Level of Reading and ACE L. Use of the English average or the ACE L, however, seemed unwarranted because of the higher intercorrelations within these two variables and the other parts of the battery. Moreoever, ACE T and the Level of Reading combination are only .0204 points lower. Furthermore, since ACE T score comprehends both the L and Q scores, it appeared wiser to select it as the predictor. Then, too, from the standpoint of economy and simplification, choice of the ACE T and the general high school average even for the psychiatric area seemed justified in order to consistently apply the same variables to all areas of the SBTP examination.

Proceeding therefore to the addition of more variables to those above by means of the DuBois method and using the first-year average in the school of nursing as the criterion variable, it was found that a six-predictor battery comprising the high school general average, Level of Reading Test, Science Test,

Speed of Reading Test, ACE T and Mathematics Test produced a coefficient of .754. A four-variable combination, omitting the Speed of Reading and the Mathematics Test, yielded a multiple of .752. This difference between the multiple R with six variables and the R with four variables is not significant according to an F test for such a difference: $F = \frac{(R^2_1 - R^2_2)(N - m_1 - 1)}{(1 - R^2_1)(m_1 - m_2)}$[8]

It is noteworthy that the Level of Reading contributes more to the battery than does the ACE when combined with high school average. The high intercorrelations of the ACE T and L scores with Speed of Reading and with the Science Test, as pointed out earlier, result in the lesser position and significance of the ACE, the Speed of Reading, and the Science Test in the multiple. The Mathematics Test and the History and Social Studies Test are of negligible value, the latter leading to no increase in the multiple. The results of the selection process are shown in the following table, Table 9.

TABLE 9

ELIMINATION OF PREDICTOR OF LEAST VALUE BY MEANS OF MULTIPLE CORRELATION OF SIX VARIABLES WITH FIRST-YEAR AVERAGE

High School Average, Reading Level Test, ACE T, Science Test, Speed of Reading Test, Mathematics Test	.7541
High School Average, Reading Level Test, ACE T, Science Test, Speed of Reading Test	.7534
High School Average, Reading Level Test, ACE T, Science Test	.7520
High School Average, Reading Level Test, ACE T	.7495
High School Average, Reading Level Test	.7399
High School Average	.6956

[8]Guilford, loc. cit., p. 400.

Using the results of Table 9 and following the DuBois method of calculating the differential weights for each of the predictors, we have for our regression equation:

$$X = .5179x_6 + .1618x_5 + (-.0616)x_4 + .0297x_3 + .0617x_2 + .0138x_1 + 28.17K$$[9]

where:

X = Predicted grade average in first year of the nursing program

x_6 = High school average

x_5 = Level of reading test score

x_4 = Speed of reading test score

x_3 = ACE T score

x_2 = Science test score

x_1 = Mathematics test score

Predicted grades for a random sampling of three students in the group were calculated by means of this equation. Results can be seen below:

	Predicted Score	Actual Score
CARD NO. 1	91.2	94.5
CARD NO. 60	78.5	79.0
CARD NO. 150	85.2	86.6

Since the standard error of estimate is 3.05 the forecasted averages come within very reasonable limits.

For reasons stated previously and also because the standard error of estimate for the SBTP criteria appears to be too large for accurate prediction,[10] the writer, nevertheless, decided to exhaust all possibilities in striving to attain a meaningful formula in prediction. She, therefore, employed the DuBois

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[9]Omitting the Mathematics Test in our equation we have K = 28.63

[10]Since the SBTP examination is recorded in standard scores with a mean of 500, the standard deviations for the medical and psychiatric, for example, are 78.65 and 72.13; the standard error of estimate is 62.65 and 63.9 respectively.

technique with several areas of the SBTP as the criterion variable to determine how much each test really contributes in prediction in comparison with the previous multiple R attained with school of nursing first-year average as criterion. Taking the Medical score as the criterion variable and using the ACE T score, the high school average, the Level of Reading Test, the Natural Science Test, the Speed of Reading Test, and the Mathematics Test scores as predictor variables, a multiple coefficient of correlation of .6046 was obtained, an increase of .0621 over the highest single coefficient derived from the ACE T alone. The following table gives the contributions of each variable:

TABLE 10

ELIMINATION OF PREDICTOR OF LEAST VALUE BY MEANS OF MULTIPLE CORRELATION OF SIX VARIABLES WITH SBTP - MEDICAL

ACE T, High School Average, Reading Level Test, Natural Science Test, Speed of Reading Test, Mathematics Test	.6046
ACE T, High School Average, Reading Level Test, Natural Science Test, Speed of Reading Test	.6032
ACE T, High School Average, Reading Level Test, Natural Science Test	.5972
ACE T, High School Average, Reading Level Test	.5953
ACE T, High School Average	.5719
ACE T	.5429

In judging a candidate's ability to succeed in the SBTP medical examination, therefore, in the sample studied one would rely chiefly on scores obtained on the ACE T, the Level of Reading Test, and the high school average, as these three variables assume the most importance.

Looking at the least representative area of the SBTP examination, the psychiatric, we find that the Speed of Reading Test alone gives a coefficient of

correlation of .4381, whereas the addition of five more variables, the ACE T score, the Level of Reading, the English average (which in this case shows more relationship than the general high school average), the Natural Science Test, and the History and Social Studies Test scores furnish a multiple R of .4639, which is an improvement of only .0257. With the standard error of estimate being 63.9, this R of .4639 seems to be of slight value, for it reduces the error of prediction by only 11.2 per cent and indicates that 21.2 per cent of the variance has been accounted for. A good individual test may do as much. For these reasons, the use of regression equations for these five criteria of the State Board tests would seem most impractical. One could predict, to some extent perhaps, the ranking of the students and also estimate those scores clustering around the mean quite accurately, but the estimate for those at either end of the scales would tend to be very unreliable. And it is in the lower end particularly that the admissions office is most concerned.

As an illustration, again taking the three cards selected previously for testing the equation derived from the first-year average as criterion, the following predictions were calculated for the SBTP - medical area.

	Predicted Score	Actual Score
CARD NO. 1	508	566
CARD NO. 60	414	411
CARD NO. 150	475	485

Then, taking a few cards not randomly selected but with borderline scores on the SBTP examination, medical area, the following predictions were obtained:

	Predicted Score	Actual Score
CARD NO. 197	448	350
CARD NO. 185	456	335

In the latter case the difference is 121 points. Such estimates would not be useful. For these reasons, to set up five separate equations for the five areas of the SBTP examination would not be feasible. Since much more than scholastic ability is operating in the outcome of the examination at this time, it seems more appropriate to forecast only the first-year average in the school of nursing and then to rely on more subjective clinical evidence which may be found in personal and educational background in making judgments on the non-scholastic traits and factors that operate in the further success of the applicant. This can be followed in the next chapter.

CHAPTER V

STUDY OF WITHDRAWAL-FAILURE GROUP

In the preceding chapter, those variables which, according to the statistical evidence, appeared to be most useful were given appropriate weights. The regression equation constructed therefrom appeared helpful in predicting probable scores or averages to be attained by the sample studied, the success group, and also by others who closely resemble that sample as far as nursing school averages are concerned but seemed most impractical in predicting individual scores on the SBTP examination in the five areas. The results are somewhat distorted, however, by the pre-selection effects; therefore, the application of the equation to those who withdrew from or failed in the program indicated that it was of little use with this group also. Many of these students had comparable scores on the PNG tests or in high school average. They had been interviewed and, in many instances, were judged to be promising candidates. Clearly, supplementary data of a non-scholastic nature, subjected to rational analysis, must be used in sound selection procedures. Consideration must be given to other factors which may serve as a part of the team of predictors. This chapter gives the results of this part of the investigation.

The data on the cards of the withdrawal-failure or non-success group seemed to show no consistent characteristics or pattern, either in scholastic ratings, test scores, or in background information. It appeared likely, however, that a breakdown according to the reasons for dropping out might give a clearer, more meaningful picture of the situation although doing so divided the

group into small categories. In addition, therefore, to the overall comparison of the success and non-success groups, an analysis according to the following types was included for any value it might have:

1. Failure group (25.5%)
2. Withdrawal for other reasons
    a. Marriage (35.7%)
    b. Dislike or lack of interest (21.4%)
    c. Miscellaneous (17.4%)

One recognizes, of course, that the reasons for withdrawal may have been influenced by factors other than those given or that these reasons often overlap or interact upon each other.

Comparison of Educational Background of Successful and Non-Successful Students

The results of the analyses are expressed in percentages. This procedure seemed more appropriate because the two groups differed in size; percentages placed both on a more equal footing for comparison of likenesses and differences in characteristics. The following tables present a graphic picture of the two groups. The term "failure" as used in the tables means all those who failed to complete the program and pass the SBTP examination.

Interpretation of Comparison

That two-thirds of the withdrawal-failure group took a minimum high school program compared with less than one-fourth of the success group that elected to take the minimum is very significant. Important also is the percentage of students in each group that elected to take a maximum program. Further analysis of the subgroups reveals that an even higher percentage of students labeled "not interested" or "marriage" chose a light program. This in itself can mean a number of things--underachievement, lower intelligence and thus

TABLE 11

UNITS TAKEN IN HIGH SCHOOL[a]

	15-16	17-18	19+
A. Success Group	23.7%	49.6%	26.7%
Withdr.-Failure Group	66.2	29.9	3.9
(Not interested)	75.0	12.5	12.5
(Marriage	76.4	23.6	—

B. Percentage of each category in terms of success or failure:

15-16 Units		17-18 Units		19+ Units	
Success	Failure	Success	Failure	Success	Failure
45.5	54.5	72.7	27.3	84.1	15.9

[a]Excludes physical education, chorus, courses carrying less than ½ credit per semester.

TABLE 12

AVERAGE IN HIGH SCHOOL

	English Av.	Science Av.	General Av.
Success Group	88.8%	86.6%	88.0%
Withdr.-Failure Group	85.4	83.5	84.0
(Not interested)	86.1	86.2	86.0
(Marriage	87.2	82.3	85.8

TABLE 13

RANK IN HIGH SCHOOL AND RECORDED IQ

	Above Median	Below Median	Recorded IQ
Success Group	83.8%	16.2%	108
Withdr.-Failure Group	56.3	43.7	105
(Not interested)	68.7	31.3	103
(Marriage)	70.6	29.4	105

TABLE 14

CURRICULUM PURSUED IN HIGH SCHOOL

	Acad.	Gen.	Commer.	H. Ec.	H. Ec. Commer.	Acad. Commer.
A. Success Group	39.4%	19.6%	25.3%	5.1%	2.0%	8.5%
Withdr.-Failure Group	30.6	28.2	21.7	13.6	5.9	—
(Not interested)	50.0	—	20.0	30.0	—	—
(Marriage)	47.1	23.5	17.8	17.6	—	—

B. Percentage of each curriculum group in terms of success or failure:

Academic Only		General		Commercial Only	
Success	Failure	Success	Failure	Success	Failure
75.0	25.0	61.9	33.1	72.7	27.3

Home Economics		Combined Acad.-Commercial	
Success	Failure	Success	Failure
53.8	46.2	78.5	21.5

TABLE 15

SIZE[a] OF HIGH SCHOOL ATTENDED

	Small	Medium	Large
A. Success Group	32.8%	29.3%	37.9%
Withdr.-Failure Group	20.3	29.0	50.7
(Not interested)			
(Marriage)			

B. Percentage of entire group in various-size schools:

Small School 29.2%		Medium School 29.2%		Large School 41.6%	
Success	Failure	Success	Failure	Success	Failure
80.2	19.8	71.6	28.4	64.2	34.8

[a]By small school is meant from 4 to 40 in graduating class; by medium school, 41 to 125; by large school, 126 to 500.

TABLE 16

INDICATION OF BEING UNDERACHIEVER

Success Group	21.7%
Withdr.-Failure Group	29.5

TABLE 17

NLN PNG RAW SCORE MEAN

Success Group	312
Withdr.-Failure Group	295
(Not interested)	304
(Marriage)	305

TABLE 18

WORK EXPERIENCE OF STUDENTS

	None	Hospital	Other
A. Success Group	47.0%	25.3%	27.7%
Withdr.-Failure Group	41.4	21.4	37.1
(Not interested)	66.7	22.2	11.1
(Marriage)	21.4	35.7	42.9

B. Percentage of each category in terms of success and failure:

No Experience		Hospital Experience		Other Experience	
45.5		24.3		30.3	
Success	Failure	Success	Failure	Success	Failure
76.2	23.8	76.9	23.1	67.9	32.1

adherence to a track system, lack of adequate programs in the high school, or lack of interest in scholastic work. The figures in Table 11 show significantly that of all those who had taken a minimum high school program 54.5 per cent were withdrawals or failures, whereas of those taking nineteen or more subjects only 15.9 per cent were among the unsuccessful group.

In checking other evidence, such as high school average, rank, IQ, curriculum pursued, it was found that the success group surpassed the non-success group although the two subgroups, marriage and not interested, remained closer to the group mean of the success group in rank in high school. Very significant is the fact that almost 84 per cent of the success group ranked above

the median in their high school class whereas only 56 per cent of the withdrawal-failure group achieved this distinction. Since 70.6 per cent of the marriage group and 68.7 per cent of the not interested group scored in the upper half of their classes, their exclusion would have meant an even lower percentage of the dropouts who belonged in the upper half of their classes. To find that these two subgroups, marriage and not interested, ranked in the upper half was somewhat surprising. On this point, they closely resembled the success group; however, a glance at Table 11 provides the information that often they had followed a light program. The not interested group bore a close resemblance to the withdrawal-failure group as a whole but had a slightly lower mean IQ. That may explain partially why they carried a minimum high school program in terms of 15-16 units.

Closely allied to the overall picture of achievement in high school is the type of curriculum purused. Although the withdrawal-failure group was rather evenly divided in its selection of an academic, a general, or a home economics program, the success group as a whole chose the academic or its combination with additional commercial subjects (47.9 per cent total), with only one-fifth of this group selecting a general curriculum. Those in the marriage or not interested groups often followed an academic program also; in fact, the percentage is even higher than for the success group. It must be recalled, however, that these two subgroups had often chosen a light program in number of units taken.

Of some import is the comparison in Table 14 which shows that those students in the academic or academic-commercial program showed the lowest percentages of failure in the nursing program while those with a home economics major or a general program had a higher rate of failure. We do not mean to imply that the type of studies had a direct influence or caused this withdrawal

or failure in the school of nursing. It is stated merely that those students in the sample who chose or were guided to a home economics major or who chose many electives showed a greater tendency to withdraw or fail.

In finding the percentages of those who were considered to be underachievers, the following criteria were used: On the basis of the recorded IQs it was assumed that a score of 95–105 was average; one of 106–119, above average; and any of 120 and above, superior. In like manner, according to the high school marking systems, C was considered average; B, above average; and A, superior. Because some of the classes varied greatly in size, rank was considered more valid in the larger classes where above-average and superior students should have been at least in the upper third and the average students near the center of the group. Any serious deviation between average and IQ would seemingly indicate underachievement, particularly if the ACE or other tests corroborated this judgment.

Interestingly enough, although 29.5 per cent of the withdrawal-failure group could be considered underachievers in high school, 21.7 per cent of the success group could also be classified as such. The probable explanation is that, although these students in the success group had not lived up to their potential in high school, a more mature attitude or more interest in this field led them to perform better in the school of nursing than they had done in the past or they at least achieved a certain minimal level of success sufficient to assure graduation and licensure. Closely related to this aspect of underachievement was the finding that 19.4 per cent of the withdrawal-failure group and 10.6 per cent of the success group had IQs above 105 and yet pursued a minimum high school program. Although both of these percentages are somewhat low, there is a 8.8 per cent difference between the two groups.

The author realizes that generalizations based on group means can be misleading at times. It must also be remembered that the number in each subgroup is very small and therefore may not be too representative of a larger population. According to the data presented in the tables, it may be said that, subject to the above limitations, the pattern of the not interested and the marriage groups in this sample may be summarized as follows: They had a slightly higher general average; a higher percentage of them ranked in the upper half of their classes than did the withdrawal-failure group as a whole. The most striking point of departure that distinguished these two subgroups was noted in Table 11, Units Taken in High School. Here they had the largest percentage of students in the 15-16 unit bracket of all the groups. If the writer may risk an interpretation, it seems that these people tended to take a lighter program than did the others; however, the lower IQ of the disinterested group combined with the higher percentage of this group that placed above the mean in rank and also achieved a slightly higher general average suggests that some members of this group withdrew because of unrealistic goals or frustration in a situation different from their high school experiences. In high school they had taken a lighter program with which they could cope satisfactorily; here they had to compete on an equal basis with all others.

Regarding the size of high school attended, it appeared necessary first of all to show the relative percentage of the entire group from the three types of schools and then to indicate the proportion of successful and unsuccessful students from each type. Although the trend is slight, it does seem that students from the smaller schools showed more persistence and stability in pursuing their nursing careers. More dropouts came from the large schools than from the small or medium-sized ones. There may have been and probably were more influences at work that also led to this situation; therefore, this better

showing from the small schools does not infer that size of school is the direct or responsible cause of the effect noted. However, size might be taken into consideration along with other factors when making judgments about the questionable stability of the candidates and their possibility of success.

In Table 18 it can be noted that there is a larger percentage of withdrawal-failures from the group of students who elected part-time work in areas other than hospital care. From this point alone one might attribute this higher rate of failure to lack of insight into what the nursing career entails. On the other hand, the record of the group that had no work experience whatever was as good as that of the group that had some hospital experience. It may be that those who worked came from a lower socio-economic level or from a more insecure home. This, too, is matter for a comprehensive and detailed study in its own right and should be investigated thoroughly. The table indicates that, in this sample, part-time work in itself did not contribute one way or another in assessing non-scholastic influences that affect a student's behavior.

Comparison of the Family Background of Successful and Non-Successful Students

Another facet investigated for possible clues to lack of motivation and persistence was the family background of the students as far as this could be determined from the cumulative record data. A summary of this information follows in the tables below. (page 89.)

Interpretation of Comparisons

From the percentages in Table 19 it appeared that girls from the rural areas had a slightly higher chance of success, all things being equal, than did those residing in the city although the school of nursing drew only one-third of its students from non-urban areas. The difference, however, is too small to

TABLE 19

PLACE OF RESIDENCE

	Urban	Rural
A. Success Group	64.6%	35.4%
Withdr.-Failure Group	70.9	29.1
(Not interested)	58.8	41.2
(Marriage)	77.8	22.2

B. Percentage of total:

In City		Other City		Rural & Small Town	
35.4%		31.0%		33.6%	
Suc.	Fail.	Suc.	Fail.	Suc.	Fail.
69.4	30.6	69.8	30.2	73.1	26.9

TABLE 20

SIZE OF FAMILY

	Only Child	2-3 Children	4-6 Children	7 or more Children
A. Success Group	8.5%	38.9%	38.4%	14.1%
Withdr.-Failure Group	5.3	42.1	44.7	7.9
(Not interested)	5.9	41.2	47.0	5.9
(Marriage)	---	33.3	44.4	22.3

B. Percentage in each category in terms of success or failure:

Only Child		2-3 Children		4-6 Children		7 or more	
Suc.	Fail.	Suc.	Fail.	Suc.	Fail.	Suc.	Fail.
81.0	19.0	72.6	27.4	73.1	26.9	82.4	17.6

TABLE 21

POSITION OF STUDENT IN FAMILY

	Youngest	Oldest	Other
A. Success Group	19.2%	37.9%	42.9%
Withdr.-Failure Group	30.9	29.4	39.7
(Not interested)	11.8	60.0	47.0
(Marriage)	11.1	44.4	44.5

B. Percentage of each category in terms of success or failure:

Youngest		Oldest	
Suc.	Fail.	Suc.	Fail.
64.4	35.6	78.9	21.1

TABLE 22

PARENTS' EDUCATION

	8th Grade or Less		Some High School		Completed High School		Some College	
	Fath.	Moth.	Fath.	Moth.	Fath.	Moth.	Fath.	Moth.
A. Success G.	26.6	22.1	33.3	28.7	25.5	35.9	14.6	13.3
W.-F. Group	23.4	19.5	28.4	39.0	32.4	34.7	16.2	7.8
(Not int.)	---	9.1	54,5	18.2	18.2	54.5	27.3	18.2
(Marriage)	28.6	7.2	14.3	42.8	50.0	42.8	7.1	7.2
B. Percentage of tot. in each:	25.5	20.9	31.6	32.0	27.0	35.5	15.6	11.6
	Suc.	Fail.	Suc.	Fail.	Suc.	Fail.	Suc.	Fail.
Father:	77.3	22.7	79.0	21.0	71.0	29.0	70.0	30.0
Mother:	79.6	20.4	67.5	32.5	76.1	23.9	86.7	13.3

TABLE 23

FATHERS' OCCUPATIONS

	Profess'al	Factory & Labor	Business & Office	Farming
A. Success Group	6.1%	52.5%	23.7%	17.7%
W.-F. Group	4.9	58.3	26.4	11.1
B. Percentage of tot. in each:	5.6	54.1	24.4	15.9
	Suc. 80.0 / Fail. 20.0	Suc. 74.8 / Fail. 25.2	Suc. 75.8 / Fail. 24.2	Suc. 81.4 / Fail. 18.6

TABLE 24

MOTHERS' OCCUPATIONS BEFORE MARRIAGE

	Nrsg. & Tchg.[a]	Factory	Office	Miscellaneous
A. Success Group	13.2%	24.8%	34.1%	22.9%
W.-F. Group	6.3	26.8	25.0	37.5
B. Percentage of tot. in each:[b]	7.7	16.5	21.2	19.2
	Suc. 85.0 / Fail. 15.0	Suc. 74.4 / Fail. 25.6	Suc. 80.0 / Fail. 20.0	Suc. 68.0 / Fail. 32.0

[a]Of this group, 4.7% had been nurses (Success), and 4.2% (W.-F.)

[b]35.4% of the mothers had not worked before marriage evidently. This group had 72.2% of their daughters being successful; whereas 67.5% of the daughters of working mothers were successful.

show a definite trend. The rural group may have been more highly motivated to succeed despite hardships encountered. This, too, is a point for careful, more

thorough study with a larger sample.

Judging from the figures listed under "size of family," an only child and a child coming from a large family of seven or more children succeeded in the nursing program slightly better than did those from other groups; however, it was interesting to see also in the next table, Table 21, that the youngest child in the family showed a much higher incidence of failure or withdrawal than did the others. The oldest child, in fact, had the best record although this same child if in the non-successful group was there usually because she was not interested. Apparently the youngest child withdrew for reasons of failure rather than because of dislike or marriage. This so-called "failure" may indicate, to some extent, however, an immaturity and lack of drive and/or lack of purpose rather than actual inability to achieve.

Regarding the educational background of parents, several speculations can be made. The mothers in this group had slightly more education than did the fathers, even though more fathers went to college. It appeared that the student nurses whose mothers had some high school education but had not graduated also had more daughters who did not graduate from the school of nursing. The rate of withdrawal or failure for this group was highest of all groups. It was also apparent that those girls whose parents had an eighth grade education or less as well as those girls whose mother had graduated from high school had about the same rate of dropouts. The largest disparity occurred in the college category where it can be noted that the girls whose fathers attended college failed 30 per cent of the time, whereas those whose mothers had some post-high school education failed only 11.6 per cent of the time. That the mother had a much stronger influence on the girl and her life goals than did the father seemed to be one plausible explanation of the various percentages exhibited in this table. According to the figures, it seemed that the girls who succeeded came chiefly

from homes where the father had some high school education but the mother had graduated from high school, or from homes where parents had but eight years or less of formal schooling. If the author may hazard a few probable reasons for these phenomena, it would seem that where the mother graduated from high school or college she herself held a higher value on education than did the mother who had not completed high school, and this opinion transferred to her daughter, who was, therefore, more willing to make the effort to achieve success. Those parents who had not had the opportunity for more than an elementary school education also held higher education in greater esteem, which point of view had an influence on the girl. Or, a girl herself, coming from a low socio-economic group, either through her mother's urging or her own desire to "make something of herself," was highly motivated to achieve success in nursing unless too many obstacles presented themselves.

A slightly better overall picture should be obtained when parents' educational background is supplemented by their occupational status. In this study, however, only slight trends were noted. For example, most of the girls, whether in the success group or in the non-success group, had fathers who were employed as laborers or factory workers. The only occupational group that showed a definite difference between the success and the non-success group was the farm group. This group had a higher proportion of successful daughters although they constituted only a small percentage of the population in this sample. This finding supports the data referred to previously that the students from the rural areas appeared to show slightly more stability and drive in reaching their goals if we measure such persistence by the withdrawal-failure rates.

The largest percentage of mothers (35.4) had not worked before marriage; a very small percentage had been teachers or nurses; the others were divided

among factory, office, and miscellaneous occupations. This latter classification might have been eliminated or roughly categorized with the factory and office jobs into two occupational groups, one requiring little education and training and the other requiring more. Because of the variety of occupations listed--aides, maids, seamstresses, cafeteria workers, telephone operators, clerks, and the like—and the smallness of each group, the author chose the miscellaneous grouping. From Table 25 the impression may be received that those mothers who had done office work had more daughters in the success group while those who had engaged in miscellaneous work had daughters who often did not achieve the success they had hoped for initially. This latter group of mothers, it should be pointed out, consisted chiefly of those who had little or no high school education and thus had to take jobs that did not require specialized training.

Summary of Comparisons

From the data submitted in this chapter on the experiential background of the students in the school of nursing, a graphic comparison between those who finished the program and became licensed on the first attempt with those who dropped out or failed before reaching their goal is given below. Subject to the limitations of this particular sample and without assumptions as to the reasons or causes of the phenomena presented, it seems that a typical student operating under the following conditions will have—

More chance of success if—	Less chance of success if—
1. her high school rank is above the median;	1. her high school rank is below the median;
2. she followed an academic or academic-commercial curriculum;	2. she followed a general curriculum with many electives or a homemaking major;
3. she elected a strong high school	3. she elected a minimum or light

program—19 units;	program—15 or 16 units;
4. she went to a small high school and lived in a rural area;	4. she attended a large city high school;
5. she was the oldest child in the family or an only child or a member of a large family;	5. she was the youngest child in the family;
6. her mother was a high school graduate or post high or her parents had an eighth grade education or less;	6. her mother had started but had not finished high school;
7. her father followed farming;	7. her father was a laborer or factory worker;
8. her mother had been a former office worker or professional but was not working now.	8. her mother before marriage had been employed in occupations requiring less education and might be working now also.

These points were considered in the charted profiles that were constructed later.

A few unique characteristics of those who withdrew because of disinterest or to get married may be somewhat indicative of these two types of dropouts although, because of the small numbers in each subgroup of the non-successes, any such statements would have to be made with reservations. In high school average, the mean of these groups did not differ substantially from that of the success group. The four-point variation in mean between the success and the non-success group was caused by the lower averages of those who failed rather than by the voluntary dropouts. This is also true with rank in class and the marriage group but not with the disinterested group. In mean IQ the disinterested group fell slightly below average, perhaps indicative of overachievement in high school. The fact that this type of person chose a light or minimum program and often worked up to her full potential in order to make acceptable averages in high school and then discovered in the school of nursing situation that she would have to take a full program in competition with all others may have

caused frustration. Perhaps in the past she had not been fully aware of her limitations.

Those in the marriage group, since they differed little from the success group except that they preferred a lighter program in high school, may have been people who had the requisite ability and worked up to par but yet had less motivation or preference for scholastic pursuits, particularly if the possibility of marriage presented itself before the nursing program had been completed. On this point, it would be difficult to assess a person's value system or to predict with any accuracy in which direction a decision may be made. Too many human and subjective factors cloud the issue.

Of those not interested, two-thirds had not done any part-time work during their high school career; of those who chose marriage in preference to finishing their nursing program, 43 per cent had done other than part-time hospital work.

Other factors, such as minimum programs offered in the high schools, lack of proper guidance, and many other unknown circumstances, may have led to the selection of light programs, type of curriculum pursued, etc. For these reasons, none of the observations made should be regarded as absolute. The writer merely points out trends and posits a possible interpretation which may be material for futher investigation.

From information gleaned from the foregoing analysis of the experiential background and from the data derived from the validity study, the following items were then set up in chart form to serve as a screening device:

1. Total PNG score
2. High school average
3. IQ
4. Reading level score
5. High school rank
6. Underachievement
7. No chemistry
8. Deficient recommendations
9. Light high school program
10. Youngest child
11. Home conditions
12. Immaturity
13. Lack of insight
16. Other

Two additional items, Urban Home and Mother's Education, were included initially in the chart. Further sifting of the evidence after plotting the profiles of the success and non-success groups led the writer to drop these, however.

For practical purposes, cutoff scores were determined and those students who fell below a pre-arranged minimum were given check marks in appropriate columns of the chart. In order to determine the cutoff scores, the data cards of the success group were sorted into types according to PNG scores, SBTP examination scores, and high school averages. Of the 198 cards, it was found that 92 students out of 94 who scored above 300 on the PNG (additive composite raw score), and who had a high school average of 90 or above also made above 500 on the SBTP, using an averaged composite for the five areas of the test. Similarly, students scoring 250 and above on the PNG and with a high school average above 84 generally scored above 400 on the SBTP examination. (Seventy-two of seventy-eight met this standard.) Fourteen students attained the 250 minimum on the PNG but did not reach the 85 per cent average. Likewise, twelve attained an 85 per cent average but failed to reach the established 250 cutoff on the PNG. Students scoring below 250 on the PNG and below 85 in high school average were given checks in the appropriate columns.

Further perusal of the cards suggested that an IQ of 100 be selected for our purpose. Students below this point received a check in this particular column. Although the IQ statistically did not appear to have a substantial relationship with the final results in the school of nursing or on the SBTP examination, it did, on analysis, seem to indicate at least some minimal prerequisite for achievement and something of a girl's potential ability when combined with other factors. For example, a low IQ added to other frustrating or negative factors would certainly have some influence on subsequent behavior or

performance. For this reason IQ was included in the list of factors.

In the same manner, checks were made in the "Average" column for students whose high school record showed a mark below 85 per cent, which, incidentally, was about one standard deviation from the mean of the group.

Since reading scores showed high correlation with success on the SBTP examination as well as with graduation from the school of nursing, the reading area was checked for those lacking minimum ability in this skill. To determine the level thought necessary for success for the generality of students, the writer noted that a score of 48 on the Level of Reading Test and of 45 on the Speed of Reading Test, which again was one standard deviation below the mean of the sample, apparently sufficed if the total raw score on the PNG was equal to 300 or if the high school average reached 84 per cent. On the other hand, when the average was four or five points lower, or when the PNG raw score total was between 250-300, the reading raw score should have been around 52, which according to the national norms given, is near the 50th percentile. In order to indicate this variation, to signify a PNG score between 250-300 and a reading level score between 48 and 52 a minus sign was used in place of a check mark.

Rank was considered, tentatively, and thus a check mark in that column indicated that the student ranked in the lower half of her high school graduating class. A check of the finished chart, however, indicated that rank in most instances corroborated the finding listed in the high school average column and would, therefore, be a duplication. Only in specific instances could it be taken as an independent standard by which to judge the candidates, i.e., one large school seemed to mark considerably lower than the small schools, particularly for students between the 50th and 80th deciles, so that a glance at the rank proved helpful in determining several averages between 82 and 85 per cent.

If a student's record on her high school transcript showed above-average

IQ but a low grade average, a check was placed in the column "Underachiever." Because the Natural Science Test had a low but substantial relationship to success, and because a study of the transcripts also showed that a girl who had not taken chemistry in high school was at a disadvantage in attempting the subject in the school of nursing, a check was placed in the column designated "No Chemistry" if a student had not taken chemistry in high school. Likewise, if a student received several recommendations given with reservations, a check was made in the appropriate column. Furthermore, if the student had carried a light high school program of if minor electives were chosen in preference to academic courses, the girl received a check in that designated column. These checks in columns six to nine were considered of equal value with the minus signs in the first five columns. In like manner, a check placed in any of the last columns, ten to fifteen, received the same weight, one-half of those in columns one to five. Unfavorable points recorded from the interview, such as lack of maturity, of insight, of questionable interest or personality traits, any items that might have a detrimental effect on student achievement and persistency, were indicated in these last columns.

To show the graphic results of the suggested screening device, eighty students from the withdrawal-failure group and the same number from the success group were charted for purpose of comparison. The first ten students in alphabetic order were selected from each year's graduating class to make up the success group profile. The eighty from the non-success group consisted of those who had complete records on all points. The following charts show concretely the differences between the two groups and also the differences within the non-success group. The greater number of check marks in the non-success group columns emphasize the many negative factors that combine to affect scholastic achievement, motivation, and persistence.

Summary of Profiles

In line with the statistical analysis, which had shown high school average to have a high correlation with the average in the school of nursing, checks on the profile, indicating high school average below an 85 per cent and/or high school rank below the class median were here also indicative of failure; and the absence of checks on the success profile pointed more strongly to high school average as the best single predictor. Only 5 of the 80 success students were below this minimal cutoff point, whereas 35 of the 80 the non-success group attained this doubtful distinction.

Another characteristic which seemed to differentiate the non-success group from the success group was that the former often had carried a light high school program. This meant either a minimum of 15 credits or from 5 to 6 non-academic electives, such as homemaking. In itself this trait appeared very significant as was shown in Table 11. Even more discrimination is possible when this factor is combined with two or three other weaknesses, such as an IQ below 100, a reading level score below one standard deviation, a record of under-achievement, no chemistry or a very low average in science, or very poor home conditions. These weaknesses showed up particularly in the failure group--those who failed courses in theory and those who failed repeatedly on the SBTP examination.

The marriage group, on the whole, achieved success scholastically. There were some, of course, who, on the basis of low academic grades in high school, probably found a career less appealing than marriage; others whose poor home conditions perhaps precipitated an early marriage; still others who because of unknown future influences would not have been able to predict their own choice a year or two previously.

As for the disinterested group, lack of insight and maturity played a

part with the decision of some; lack of motivation with others, as indicated by checks in the columns "Light Program" or "Underachievement."

One other item of special import was "Qualified Recommendation." The principal, in many instances, gave a reliable estimate of a student's weakness, if not of her strengths. For example, when lack of persistence was indicated, the point was usually well made.

In short, from the evidence it seems that a good student, one with above-average IQ and an able reader, can overcome disadvantages of a light program, no chemistry, or even underachievement with proper motivation, but the poor student of low IQ and poor reading habits becomes frustrated with the above situation or cannot cope with the difficulties.

SUCCESS GROUP PROFILES

Card No.	Low PNG	H. S. Av. Below 85	IQ Below 100	Low Reading Score	H. S. Rank Below Md.	Under-achievement	No Chem	Qualified Recommen.	Light H. S. Program	Home Conditions	Youngest Child	Immature	No Insight	Other
1	X			X					X					
2											X			
3	X	X	X	X	X		X		X					
4							X		X					
5	X						X	X	X					
6						X					X			
7														
8											X			
9									X					
10	X			X				X	X					
26											X			
27														
28	X			-					X					
29	X			X										
30							X	-						
31		X			X	X		X						
32	X			X										
33														
34				X			X	X	X					
35														
41									X					

SUCCESS GROUP PROFILES

Card No.	Low PNG	H. S. Av. Below 85	IQ Below 100	Low Reading Score	H. S. Rank Below Md.	Under-achievement	No Chem.	Qualified Recommen.	Light H. S. Program	Home Conditions	Youngest Child	Immature	No Insight	Other
42								X	X					
43	X		X	X										
44							X				X			
45														
46														
47				X			X		X					
48				X				X	X					
49														
50				X										
67														
68														
69		X			X			X						
70				-										
71		X	X	X	X		X		X					
72							X							
73														
74								X	X					
75														
76									X					
77									X					
98				X										

SUCCESS GROUP PROFILES

Card No.	Low PNG	H. S. Av. Below 85	IQ Below 100	Low Reading Score	H. S. Rank Below Md.	Under-achievement	No Chem.	Qualified Recommen.	Light H. S. Program	Home Conditions	Youngest Child	Immature	No Insight	Other
99														
100				-				X	X					
101								X						
102														
103														
104														
105														
106								X						X
126	X			X			X		X					
127				X										
128				X									X	X
129													X	
130				X						X		X		
131														
132									X					
133							X		X				X	
134							X	X						X
135														
156														
157									X					
158														

SUCCESS GROUP PROFILE

Card No.	Low PNG	H. S. Av. Below 85	IQ Below 100	Low Reading Score	H. S. Rank Below Md.	Under-achievement	No Chem.	Qualified Recommen.	Light H. S. Program	Home Conditions	Youngest Child	Immature	No Insight	Others
159				X										
160														
161														
162														
163														
164														
165														
175				X				X	X					
176														X
177									X		X			
178				X	X				X					
179		X			X				X					
180														
181	-			X									X	
182								X					X	X
183								X						
184											X			

WITHDRAWAL-FAILURE GROUP PROFILES

Card No.	Low PNG	H. S. Av. Below 85	IQ Below 100	Low Reading Score	H. S. Rank Below Md.	Under-achievement	No Chem.	Qualified Recommen.	Light H. S. Program	Home Conditions	Youngest Child	Immature	No Insight	Other
*F1	-	X			X	X	-							
F2	X	X			X	X	-		X					
F3	-	X			X	X								
F4		X				X	X	X	X					
F5	-	X			X	X		X	X	X				
F6	-	X			X	X								
F7	-	X			X	X	X	X	X	X		X		X
*F8	-	X			X				X					
F9	-	X	X		X				X		X			
F10	-						X		X					
*F11	-													
F12														
*F13	X		X	X					X		X			
*F14	X	-		X				X	X		X		X	
*F15	X		X	X			X		X		X			
*F16	-			X				-	X					
*F17										X		-		X
*F18	-					X					X			
*F19	-				X				X					X
*F20	X							X	-	X	X			
*F21						X		X	X					X
F22	-							X		X				X

("F" indicates those who failed in courses; "*F" indicates failure on SBTP.)

WITHDRAWAL-FAILURE GROUP PROFILES

Card No.	Low PNG	H. S. Av. Below 85	IQ Below 100	Low Reading Score	H. S. Rank Below Md.	Under-achievement	No Chem.	Qualified Recommen.	Light H. S. Program	Home Conditions	Youngest Child	Immature	No Insight	Other
F22	X	X		X	X			X	X	X				X
F24	-	X	X		X			X	X					X
*F25	-	-	X					X						
*F26	-	-		X					X					
F27	-	X			X		X	X	X					X
*F28	-	-					-		X					
F29	-						X	X	X	X	X			X
F30	X	-					-	X						X
F31	X	X			X		-	X					X	X
F32	X	X	X		X			-	X			X	X	X
F33					X		X		X				-	
F34					X	X	X		X				-	
F35	-	X	X		X			X	X				X	
F36	-	X	X	-	X			X	X				X	
F37	X	X	X	X	X		X	-	X				X	X
F38	X	X	X	X	X		-	X	X				X	X
F39	X	X	X	X	X									
F40	X	X	X	X	X		X		X					X
F41	X	X	X	-	X				X					

("F" indicates those who failed in courses; "*F" indicates failure on SDTP.)

WITHDRAWAL-FAILURE GROUP PROFILES

Card No.	Low FNG	H. S. Av. Below 85	IQ Below 100	Low Reading Score	H. S. Rank Below Mi.	Under-achievement	No Chem.	Qualified Recommen.	Light H. S. Program	Home Conditions	Youngest Child	Immature	No Insight	Other
M42	-								X	X				
M43	-	X					X		X					
M44	X	X	X		X				X					
M45	X							X						X
M46	-							X	X	X				
M47														
M48														
M49							X	X				X	X	
M50	X								X	X				
M51		X												X
M52		X			X	X	-							
M53		X			X		X							X
M54									X					
M55									X					
M56									X					X
M57	-											X		X
M58	X	X	X		X				X		X			X
M59		X			X	X	X		X	X				

("M" indicates those who dropped out to get married.)

WITHDRAWAL-FAILURE GROUP PROFILES

Card No.	Low PNG	H. S. Av. Below 85	IQ Below 100	Low Reading Score	H. S. Rank Below Md.	Under-achievement	No Chem.	Qualified Recommen.	Light H. S. Program	Home Con-ditions	Youngest Child	Immature	No Insight	Other
I60	-	X	X	X	X	-		X						
I61	X	X	X	-	X		X	X	X	X			X	X
I62			X	X					X	X			X	
I63	-			X			X		X		X		X	X
I64	X			X					-					X
I65	-		X				X		X				X	X
I66	-		X					-	X					X
I67						X								X
I68						X					X			X
I69	X	X						X	X					
I70							X	X	X	X				X
I71	-										X			
I72							X		X	X				
I73										X				X
I74						X		-	X		X			
I75						-		X	X					X
I76									X					X
I77							X		X	X				X
I78	-						X					X	X	
I79		X		X	X				X					X
I80				-	X				X	X				

("I" indicates those who listed "not interested" or "disliked practice" as reasons for withdrawal.)

CHAPTER VI

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

This study, designed primarily to examine the predictive value of the National League for Nursing Pre-Nursing and Guidance Test Battery (NLN PNG), considered relative and combined validities of the battery and of achievement and IQ data from the high school transcript in relation to seven criterion variables: first-year and final averages in the school of nursing and the five areas on the State Board Test Pool Examination (SBTP). The predictor variables, available from data on file in the school office, were: the American Council on Education Psychological Examination—T, Q, and L raw scores; Reading Tests: Level of Comprehension and Speed of Comprehension scores; Natural Science Test scores; History and Social Studies Test scores; Mathematics Test scores; high school averages; English averages; science averages; mathematics averages; IQ; and high school rank-in-class. The population included eight classes of students at the St. Joseph's Hospital School of Nursing.

Zero-order coefficients of correlation and intercorrelation were calculated on an IBM 1410 computer; the DuBois method of multivariate correlational analysis was used to determine those variables of greatest value in the multiple and to determine differential weights for the predictors used. To supplement this statistical analysis, a modified case history approach was used to examine the records of the withdrawal-failure group in an effort to determine characteristics that may be clues to potential dropouts.

Summary of Findings

The results of the statistical treatment may be summarized by the following statements:

Through reference to the Wallace-Snedecor tables[1] it was found that all obtained coefficients of correlation were larger than the minimum r significant at the .05 level of confidence; i.e., the obtained r's could arise by chance when $\bar{r}$ is zero only five times in 100. In fact, all but two coefficients, the ACE Q vs. SBTP psychiatric and high school rank vs. SBTP obstetric, were greater than the minimum r significant at the .01 level of confidence.

No single predictor variable showed the highest correlation with all seven criterion variables. High school average and rank were the best single predictors on the basis of first-year and final grade averages; ACE T and/or L scores correlated best with all areas of the SBTP examination, except in the psychiatric area where the reading tests achieved first place.

The best combination of tests included the ACE T, the Reading Level, and the Natural Science tests. When combined with high school average, the Level of Reading Test contributed more than did the ACE T in relation to the first-year average in the school of nursing because of the lower intercorrelations.

The History and Social Studies Test and the ACE Q score might well be ignored in the battery; the Mathematics Test is of doubtful value. Only when used with ACE L did the latter produce a higher multiple than any other two-test combination in relation to averages in the school of nursing; this was due to the lower intercorrelations between the two tests. The IQ, as measured by the various tests, ranked lowest of all transcript data in its relationship to success as measured by grade averages and the SBTP examination.

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[1] J. P. Guilford, Fundamental Statistics in Psychology and Education (New York: McGraw-Hill Book Company, Inc., 1956), pp. 538-39.

The high intercorrelations within the PNG battery reduced its validity somewhat; particularly those between the ACE T score and the Speed of Reading Test; the ACE L score and the Speed of Reading Test; the T and the Natural Science Test; the L and the Natural Science Test; the Level of Reading Test and Speed of Reading Test; the Speed of Reading Test and the Natural Science Test. Unfortunately, low intercorrelations occurred only within those tests that seemed to have minimum relationship with criterion variables.

There were slightly higher correlations between all predictor variables and the first-year average in the school of nursing than between predictor variables and final average. Between the former, the coefficients ranged from .314 to .696, with a median of .511; between the latter, the range was .266 to .678, with a median of .399. The first-year average also showed higher correlations with the SBTP examination than did the final average. These validity coefficients ranged from .403 to .562 for the former and .362 to .482 for the latter. For this reason, and since the first year is the most crucial period of the program (most failures and dropouts occur at this time), and because the use of the SBTP examination scores would necessitate five different prediction formulae, utilization of the first-year average as the criterion measure in a regression equation appeared to be more feasible. Furthermore, the standard error of estimate was too large for accurate prediction with the SBTP scores.[2]

Mathematics and science averages on the high school transcript showed lower relationships with the test battery than did the English average. The mathematics average was as useful as the mathematics test score, irrespective of of the type of mathematics courses taken in high school.

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[2]The SBTP examination scores are standard scores with a mean of 500. The population in this study had means varying from 491 to 530 and standard deviations ranging from 72.13 to 78.92.

The psychiatric area on the SBTP examination revealed a distinctly different pattern from the other areas. With all other criterion variables, the high school average and the ACE T, or the T and the Level of Reading Test, or a combination of these three provided one of the best multiples; in the psychiatric area, Speed of Reading and the English average or ACE L and Level of Reading gave the most weight to the multiple. In fact, the Speed of Reading relationship showed a coefficient of .4381, whereas the addition of five more variables increased the R to only .4639. One would hope for a higher coefficient in order to predict with a reasonable amount of success.

The five variables chosen for the regression equation in predicting first-year average were, in the order of importance, high school average, Level of Reading Test, ACE T, Natural Science Test, and Speed of Reading Test. These yielded a multiple of .7534, which indicates a relatively high relationship with the criterion. The first three variables produced a coefficient of .7495, a decrease of only .0039 points. Application of the F test to determine whether or not there was a significant difference between these two multiple R's indicated that there was not. The slight increase that was noted with the addition of tests (due to high intercorrelations, which point to an overlapping or duplication of factors) when balanced against matters of administrative effort would suggest that the three-variable battery could be used effectively.

Although these weighted variables enabled the writer to predict success in the first year accurately enough for the group that actually succeeded, the same equation could not be used in forecasting probable averages for those who eventually dropped out of the program. Since more than scholastic ability was operating in the withdrawal-failure group, the statistical data was combined with more subjective evidence gleaned from the personal and educational

background of the students. A few striking differences were found in the educational background and several others were indicated in the home background that may be worth pursuing further by means of more controlled procedures and larger samples.

Two-thirds of the non-success group had taken a minimum high school program, whereas less than one-fourth of the success group had done so. Conversely, only 3.9 per cent of the withdrawal-failure group had taken nineteen or more units while 26.7 per cent of the success group had elected a maximum program.

Closely related to the above finding was the discovery that a higher failure rate occurred from among those students who had taken a homemaking major in high school.

Almost 84 per cent of the success group ranked in the upper half of their graduating classes while only 56 per cent of the withdrawal group had done so.

There was only a three-point difference in mean IQ of the groups--108 and 105 respectively; a 4 per cent difference in general average--88 and 84 per cent respectively.

Students who had no part-time work experience or who had worked in hospitals fared equally well in the nursing program. Those who did other types of part-time work were less successful.

More dropouts came from the larger schools in urban areas and from homes where the mother had not completed high school.

Children from large families, the oldest in the family, and an only child appeared to have more chance for completing the program, particularly when the parents had not had the opportunity for any high school education or when the mother had completed secondary school or had some higher education.

Conclusions

Judging the data derived from the comparative analysis and from the validity study, the investigator concluded that no one factor or specific condition, either in educational or home background, led to withdrawal or failure but rather a combination of causes and conditions were evident. The educational factor can be measured by the ACE T score (or probably by any like scholastic ability test—verbal), the high school average, and the Cooperative Reading Level Test. In fact, the high school average consistently outranked any other predictor variable for effectiveness in forecasting the school of nursing grade. This scholastic factor, however, must be reinforced by a student's drive and persistence, which are affected by weaknesses or deficiencies in experiential and environmental background. From the charts constructed to show each student's profile, it can be seen that a single summative score or even a weighted composite is insufficient in predicting success. It is essential to see the personality in its totality, view the pattern that has been built up over the years.

From the foregoing evidence, therefore, it is the writer's opinion that, although the NLN battery has some value in academic prediction, it also leaves much to be explained. It may serve as a device for salvaging those who have the requisite capacity for study but who did not live up to their potential in high school. It may be used to re-assess the high school record, especially when the quality of the high school program is questioned. Finally, it may serve in combination with the high school average to predict a likely average in the first year of the program. Its use in this instance will reduce the error of prediction about 34 per cent. In all three cases, the use of the ACE T and the Level of Reading Test with the high school average appears to be an economical, time-saving, and trustworthy means of predicting success. For more refinement, the Natural Science Test and the Speed of Reading Test may be added in a

weighted composite. In this case, the writer favors an additive composite used as part of a profile. The profile will cogently point to other factors that should be considered in assessing the probability of success. A greater number of check marks in the various columns will call attention to serious deficiencies or the need for intensive guidance and counseling if the school decides to accept the lower-ability students.

As indicated earlier, it seems, too, that a student with a below-average IQ may succeed only if other factors compensate in some degree for this deficiency—factors such as at least average reading ability, above-average achievement in high school or a very high known degree of motivation.

The implication that perhaps the achievement tests in the battery are unnecessary except in the reading field follows, to some extent, the extensive research done by Hills[2] in Georgia colleges where it was found that the use of five to eight achievement tests in addition to the College Entrance Examination Board Test and the high school record added only a negligible amount to the multiple.

The writer recommends a cutting score of 300 on the composite; one of 250 can be accepted as the absolute minimum if high school average reaches 85 per cent or higher. On the other hand, an average of 80 may suffice in some exceptional instances; for example, when the PNG raw score reaches 300 or more or when the Level of Reading is one standard deviation above the mean (roughly a score of 60).

The degree of success on the SBTP appears to be influenced by many variables not tested by the PNG or by the high school average. The PNG, for

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[2]John R. Hills, et al., "Admissions and Guidance Research in the University System of Georgia," Personnel and Guidance Journal XXXIX (February, 1961), 452-57.

example, can predict in part insofar as verbal factors are measured; but scores on the SBTP examination are also strongly affected by the stress placed on the various areas in the school of nursing and by extraneous influences also operating on the candidate. Many failures on the SBTP examination may also reveal weak spots in the curriculum or point to the fact that the school is accepting too many students of low scholastic ability.

The lower coefficients between the PNG and the final average could be due to the fact that the PNG tests as well as the SBTP examination are essentially cognitive in nature and designed to predict academic success while clinical practice (reflected in the final average) involves not only intellectual abilities and skills but also personality characteristics not tapped by the tests. Moreover, it could also be that assessment of clinical grades, particularly if schools are trying to develop and measure such traits as self-direction, critical thinking, sense of responsibility, and so on, complicates the grading problem, already one of great subjectivity.

Although the coefficients obtained in this study between the ACE and the various areas of the SBTP examination were somewhat lower than the Schotzko study, on the whole they did form a similar pattern. While Schotzko recommended the use of the L score with the five areas of the SBTP because these coefficients were, on the average, equal to the T, the writer inclines to the use of the T score for two reasons: (1) The computer immediately chose this variable and discarded the L in the process of selecting variables that contributed the most to the equation; and (2) some aspect of the quantitative factor should aid in prediction, if only to a slight degree.

Recommendations

Improving the means of selection for admitting students to the progress

in nursing must be a continuous process; there is no one solution or permanent answer. Yearly checks to note the validity of the various criteria as they function with the constantly changing student body, curricula, and SBTP examinations would seem to be valuable. It is recommended, therefore, that follow-up studies be made to determine the long-range value of the profiles with the suggested cutoff scores particularly in making decisions involving "borderline" cases. If the admissions office decides to accept such candidates on a trial basis, the profiles should indicate to the counselor those areas in which negative factors affect basic needs so that she may work more closely with the candidates in guiding them to make satisfactory adjustments.

It is also recommended that follow-up studies be made to see how closely success as measured by averages in the school of nursing and as measured by the SBTP examination will be related to success "on the job" through some valid objective means of job performance ratings in the clinical areas.

It is hoped that the specific information and suggestions offered for this hospital school of nursing may also serve as a point of departure for other schools in evaluating their admission policies and in attempting further research into some of the questions raised in this study, particularly those related to the environmental background of the withdrawal-failure group. The exploration of biographical area in this study and the hypotheses offered may well serve as a starting point in a statistical check of the total biographical area. It would seem that biographical data in combination with high school grades and a valid intellectual ability test should increase predictive effectiveness.

A study relative to obtaining a more valid type of written recommendation that would more accurately assess a candidate's personality and character would also be in order. This should include the types of persons who ought to

evaluate and recommend the prospective student nurse.

Finally, to increase the holding power of the school, a strong guidance program, including enlightened recruitment and selection measures, a continuous orientation program to help the students meet and adjust to new situations as they appear, and, in particular, able counselors to whom the person with doubts and difficulties will have recourse, seems to be of primary importance.

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Approval Sheet

The dissertation submitted by Sister M. Joel Lampen, P.H.J.C. has been read and approved by five members of the Department of Education.

The final copies have been examined by the director of the dissertation and the signature which appears below verifies the fact that any necessary changes have been incorporated, and that the dissertation is now given final approval with reference to content, form, and mechanical accuracy.

The dissertation is therefore accepted in partial fulfillment of the requirements for the Degree of Doctor of Education.

May 28, 1964
Date

Arthur P. O'Mara
Signature of Adviser